

SERVICE MARKET ANALYSIS AND FORECASTS

SMALL SYSTEMS

INPUT

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SMALL SYSTEMS

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1984 c.1

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Service Market Analysis and Forecas

TITLE

Small Systems

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CAT. No. 23-108

PRINTED IN U. S. A.

DECEMBER 1984



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I INTRODUCTION

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- The small-systems service market is experiencing major changes primarily as a result of dramatic shifts in the minicomputer products offered and the markets that these products serve. Small-system vendors are searching out new markets, such as office automation, and appealing to those markets with a wide variety of products ranging from 8-bit distributed systems up to powerful 32-bit superminis. The changes--particularly in market strategy--have resulted in a much higher level of dependence on service revenue for most small-system vendors.
- The purpose of this report is to identify trends in the small-system service market, to demonstrate how these trends will affect the overall market, and to suggest possible "action plans" that will help INPUT's clients to take advantages of the inevitable changes in the small-system service market. The report focuses on the traditional 16-bit minicomputer market, but also discusses the 32-bit superminicomputer market where applicable.
- This volume is divided into five sections:
 - The Executive Summary is designed to present a brief overview of the most prominent findings and recommendations of the report.
 - The Small-System Service Market Analysis provides a financial overview of the small-system, third-party maintenance (TPM), and total service market for 1984-1989.

- Small-System Product Analysis is a review of the latest small business system, minicomputer, and superminicomputer products arranged by vendor. Also included in this section is a summary of the effect of new products on service trends.
 - Service Development Trends discusses the specific service trends affecting hardware and software maintenance, professional services, educational services, and pricing of services.
 - Conclusions and Recommendations concentrates on long-term recommendations in such areas as 1) anticipation of increasing user pressure on the small-system service market, 2) how to accommodate lower hardware service pricing in the future, and 3) taking advantages of new growth in the third-party maintenance market.
- The information in this report was based on interviews with and comments from 386 small-system users as well as extensive on-site interviews with 19 of the top small-system vendors in the United States. The questionnaires used in these interviews are included in Appendixes A, B, and C of this report.
 - In addition to primary research, INPUT has used a number of secondary sources for background information. These sources include annual reports, 10K reports, and articles from professional journals and the trade press.

II EXECUTIVE SUMMARY

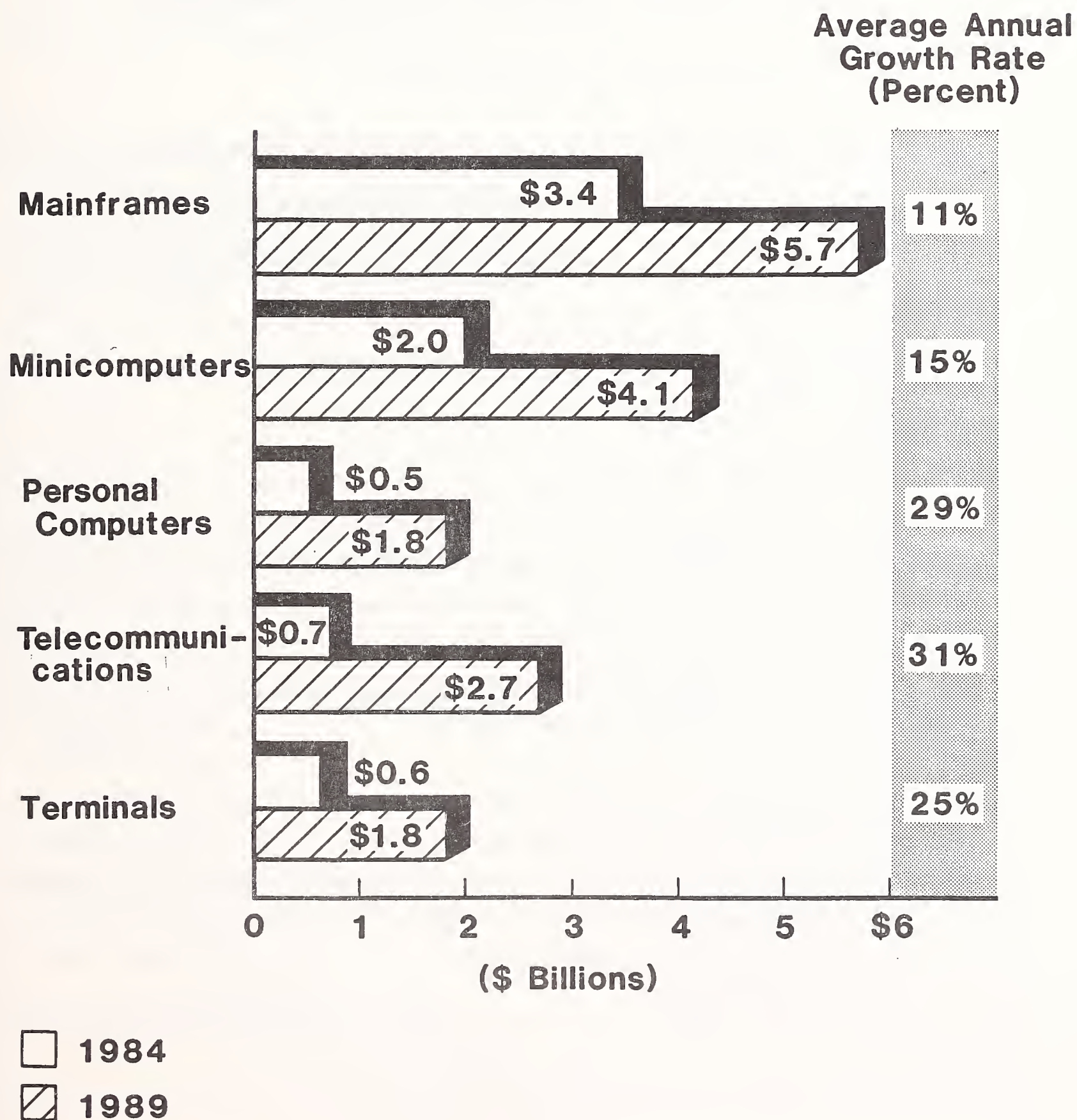
II EXECUTIVE SUMMARY

- This executive summary is designed to help the busy reader quickly review the research findings of this report without having to read each section, while ensuring that key points are not missed. Each main point is summarized as an exhibit and an accompanying script is given on the facing page. The format is designed to facilitate use of the executive summary as an in-house overhead presentation.
- The minicomputer market was born as a result of an unmet need by users for an inexpensive, user-friendly computer. However, as if history was determined to repeat itself, small-system vendors became complacent and are now scrambling to regain market share lost to competitive microcomputer and mainframe vendors. Service is becoming a major weapon in the small-system vendor's arsenal of competitive weapons. Minicomputer vendors are just now learning what successful mainframe vendors have known for years—service is absolutely necessary to the long-term success of the company.
- One of the major changes INPUT expects in the small-system service market from 1984–1989 is a reemphasis on a total after-sales support market as opposed to the current hardware-maintenance-dominated market. Small-system vendors will rely less on OEM and value-added dealers to access new markets. In addition, the manufacturers will concentrate more on vertical market integration to the exclusion of many independent software vendors. As a result of these changes, small-system vendors will become much more dependent upon their service networks not only to maintain high customer satisfaction levels, but also to support initial sales as well.

A. SERVICE REVENUE FORECASTS, 1984-1989

- Overall service revenue for small systems is expected to increase from \$2.0 billion (annually) in 1984 to \$4.1 billion in 1989, an average annual growth rate of 15%. While small systems continue to be one of the largest service markets in 1989, it will also be one of the slowest growing markets.
- The major causes of the slow down in the minicomputer service growth rate is the intense competition in equipment sales in this market. The minicomputer market is being "squeezed" at the low end by very powerful and inexpensive minicomputers and at the top end by very economical mainframes like the IBM 4300 series. After missing the boat on the microcomputer market, some small-system vendors were quick to react at the high end with a powerful 32-bit "superminicomputer." These new products represent the lion's share of service revenue growth between 1984 and 1989.
- Small-system vendors will be hard pressed to benefit from the 29% annual growth rate in personal computers. Minicomputer vendors such as Hewlett Packard have identified the PC market as a priority area, but it remains to be seen if any of the traditional small-system vendors can stay in the market by 1) acting as quickly as a new start-up company in assessing the PC markets' needs and bringing the technology to market, or 2) have the staying power of industry giants such as IBM or AT&T.
- The growth in service revenue for terminals will be based, in large part, on sales of innovative new products, however. Competition is expected to keep service profitability quite low in this area. Telecommunications service will be a high flyer from 1984-1989, but the competition will be very steep. Small-systems and microcomputer vendors will probably not derive a significant portion of this \$2.7 billion market.

SERVICE REVENUE FORECASTS, 1984-1989



B. THE CHANGING MIX IN SMALL-SYSTEMS SERVICE

- Of the four major small-system service sectors, only hardware maintenance revenue is declining in proportion to total service revenue. Total hardware revenues will increase (from \$1.5 billion in 1984 to \$2.5 billion in 1989) but at a relatively slow annual rate of 11%. The major growth sectors will be in software maintenance and support (27% AAGR), educational services (29% AAGR), and professional services (23% AAGR).
- Although small-system hardware maintenance will not be growing as quickly as other service sectors, it will still represent the major revenue generator through 1989. Hardware maintenance growth will be slowed somewhat by lackluster sales of traditional minicomputer systems, falling equipment prices, and competition from third-party maintenance vendors. Revenue growth would be much lower were it not for new revenue infusions resulting from high-end superminicomputer sales.
- Software maintenance and support will represent an increasingly important source of service revenue particularly as equipment manufacturers expand their role in vertical market integration. INPUT expects minicomputer vendors to provide software in such crucial areas as CAD/CAM and office automation, bypassing their traditional allies, OEM vendors. This move will provide the manufacturers with direct access to high growth markets and increase software support revenues greatly.
- Both educational and professional services are growing very rapidly, but will continue to represent a relatively small revenue source by 1989. However, these services take on an importance beyond their revenue when other factors such as contributions to equipment sales and higher customer satisfaction rates are considered. In addition, educational services, in particular, have a very high profit margin.

THE CHANGING MIX IN SMALL-SYSTEMS SERVICE

- **Hardware Maintenance Is the Only Services Sector which Is Declining in Proportion to Total Services Revenues**

	1984	1989
Hardware Maintenance	76%	62%
Software Maintenance and Support	15	24
Professional Services	5	7
Educational Services	4	7

C. IMPACT OF SMALL-SYSTEM SERVICE COMPETITION

- Competition in the small-system service market will increase dramatically in the next five years as vendors begin to exploit service as a way to increase bottom-line revenues growth. INPUT projects that by 1989, some small-system vendors will be earning over one-third of their total revenue from after-sales support services. However, overall revenue growth and profitability growth will not be equal between vendors.
- Increasing competition will force some vendors into the downward spiral of price cutting. This will happen primarily in the hardware service sector. Vendors that promote the full service image may not report revenue increases as large as the discount service vendors, but the full service vendor's profitability will be much higher.
- The reasons for increased competition vary by small-system sector. At the low end of the small-system/minicomputer market, the equipment vendors are very equipment price competitive (and therefore service price competitive as well) in order to fight off microcomputer penetration. Mid-range, 16-bit minis are particularly susceptible to TPM vendors because of the age, large installed base, and high population density of these machines. The TPM competition is based primarily on price, thereby forcing the entire pricing structure for these mid-range machines down.
- Service competition at the high end of the small-system market is not so intense due to the complexity and relatively small installed base of these powerful superminis. It is only at this high end that vendors are justified in basing service price on a percentage of purchase price. Where competition is most intense (at the mid- and low-end of the small-system service market), vendors should base price on the level of service quality required and specific user needs.

IMPACT OF SMALL-SYSTEM SERVICE COMPETITION

- **Increased Competition makes a Full Service Image Vital. Hardware Maintenance Is Still the Number One Service Requirement, but Total Maintenance Turnaround Time Is Growing in Importance**
- **Small-System Competition Is Coming from Independent TPM Vendors and Minicomputer Manufacturers that Are Expanding their Service Network**
- **Service Pricing Based on Percentage of Purchase Price No Longer Valid - - Determined by Service Quality and User Needs**

D. FOCUS ON SMALL-SYSTEM USER REQUIREMENTS

- Small-system users are not as cohesive a group as, say, mainframe users, but minicomputer vendors must identify the various user segments service needs in order to ensure a successful and profitable service program.
- In the past, small-system vendors have had a closed market by servicing only their own equipment. Service options were limited and, because of the general unreliability of the equipment, users were forced to accept what the manufacturer offered. Currently, small-system users are beginning to assert themselves, demanding an increased flexibility in service. This trend will continue into the future.
- Small-system users are moving away from demands for improved individual services in favor of fully integrated systems support (capable of satisfying all service needs with one call). Software support, consulting, and training will become relatively more important to users in the next five years particularly as hardware becomes more reliable.
- Increased emphasis on system performance will make small-system users appear to be a more cohesive group than they actually are. Vendors must be prepared to increase the number of unbundled service options to satisfy their increasingly individualistic user base. For example, the technical/scientific user will require far less software support than an office automation user. In addition to unbundling services, vendors can further increase service flexibility by developing and promoting small-system user self-support.
- Overall, INPUT believes that vendors must concentrate on improving service quality, defined as conformance to user requirements. While not all services will necessarily conform to specific user requirements, any service that does not contribute to satisfying user needs should be discarded as unnecessary to the profitable long-term operation of the service vendor.

FOCUS ON SMALL-SYSTEM USER REQUIREMENTS

1984 USER REQUIREMENTS

- **Single-Source Maintenance of Mixed Vendor Hardware**
- **Increase Service Flexibility**
- **Focus on Service Quality**
- **Service Must be Price Competitive**



1989 USER REQUIREMENTS

- **Consolidate all Post-Sales Support**
- **Emphasize System Integration**
- **Reprioritize Support Services**
 - **Software Support**
 - **Planning/Consulting**
 - **Improve Self-Support Options**

III SMALL-SYSTEM MARKET ANALYSIS

III SMALL-SYSTEM MARKET ANALYSIS

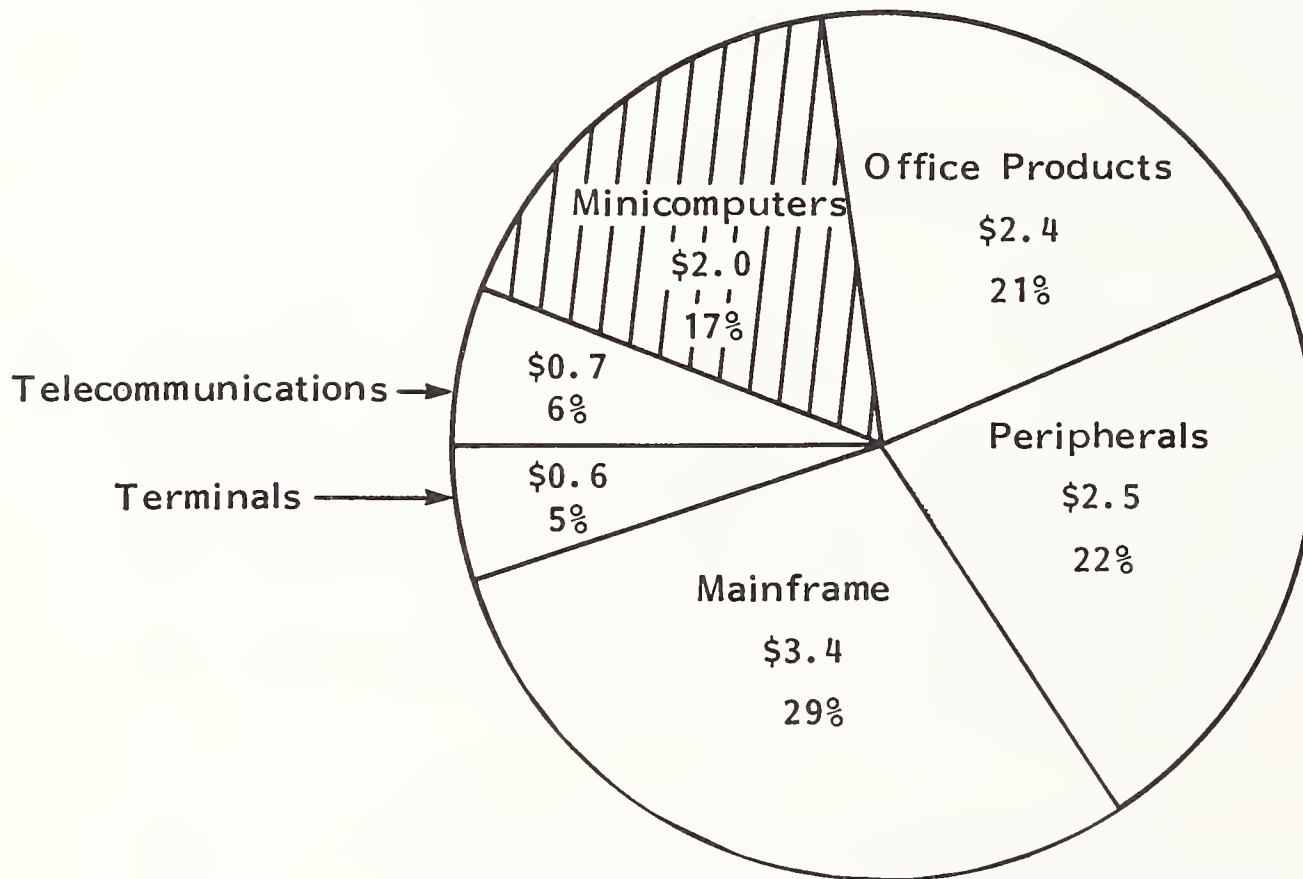
A. CURRENT MARKET FOR CUSTOMER SERVICES

I. TOTAL MARKET SERVICE REVENUE 1984-1989

- The total customer service market--as defined by INPUT--includes service on mainframes, minicomputers, peripherals, office products, and telecommunication products. The total service revenue on these products in 1984 is \$11.6 billion and by 1989 is expected to increase at an average annual growth rate (AAGR) of just over 17% to \$26 billion.
- Exhibits III-1 and III-2 demonstrate the service market segmentation in 1984 (III-1) and 1989 (III-2). As the exhibits indicate, while all the segments are growing in absolute dollars, telecommunications and office products services will be experiencing the fastest overall growth. Service growth is effective by a number of factors, some of which are unique to a particular market segment.
 - Mainframe. Currently, service on mainframes generates \$3.4 billion, 29% of all service revenue. This figure is expected to increase by almost 11% annually thru 1989 (to \$5.7 billion). While this increase will keep mainframes at or near the top of the total service revenue list, overall growth is the slowest of all service segments. Mainframe service will be hurt by a relatively slow equipment growth rate, higher

EXHIBIT III-1

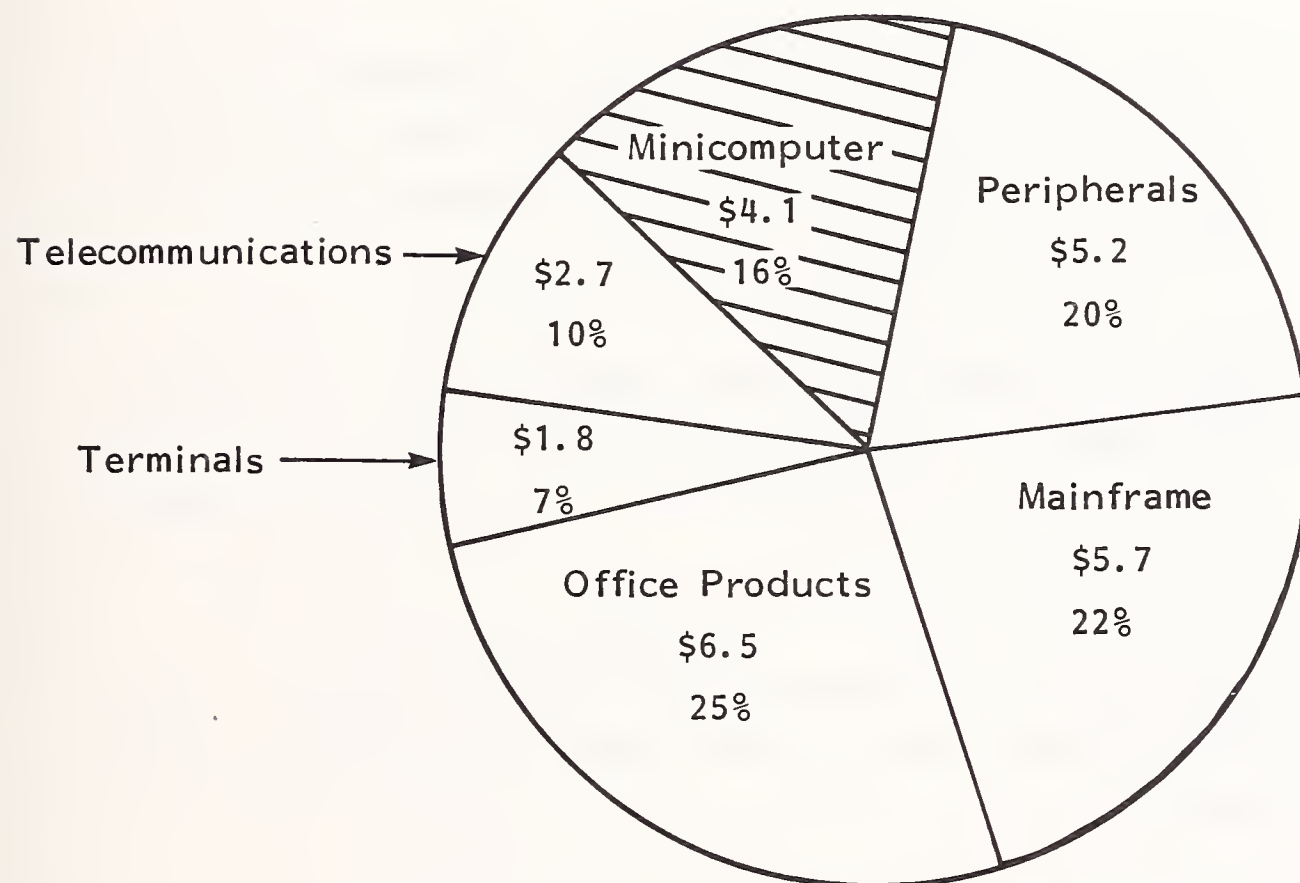
1984 CUSTOMER SERVICE REVENUES BY MARKET
(\$ Billions)



Total Service Revenue in 1984: \$11.6 Billion

EXHIBIT III-2

1989 CUSTOMER SERVICE REVENUES BY MARKET (FORECASTS)
(\$ Billions)



Total Service Revenue Forecast in 1989: \$26.0 Billion

1984-1989 Total Service AAGR: 17%

reliability (resulting in lower service calls), and competition-induced service price cutting.

- Minicomputer. This market segment represents 17% of all service revenues in 1984 shrinking to 16% in 1989. Overall, revenue will grow at 15% annually through 1989. The minicomputer service market (discussed in greater detail in the next section) is affected by three key factors.
 - . A high level of product segmentation. The superminicomputer products are growing quickly (25-30% a year depending on application or target market) while traditional 16-bit minicomputers are on the decline.
 - . There is a tremendous amount of competition in the minicomputer market. No one vendor dominates, as in the mainframe market, and as a consequence there is less service price leadership in this market.
 - . The market is not necessarily dominated by vendors. Value Added Resellers (VARs) are an important force that could affect service.
- Peripherals. Service on disk and tape drives, controllers, etc. will lose a small percent of market share between 1984 and 1989, but overall revenues will increase from \$2.5 billion to \$5.2 billion--an average annual increase of almost 16%. As with the mainframe market segment, peripherals will be subject to intense service price cutting pressures both from competition and by user demands. However, unlike mainframes, reliability (particularly on disk drives) will not improve. This could result in lower profitability levels for peripheral service vendors.

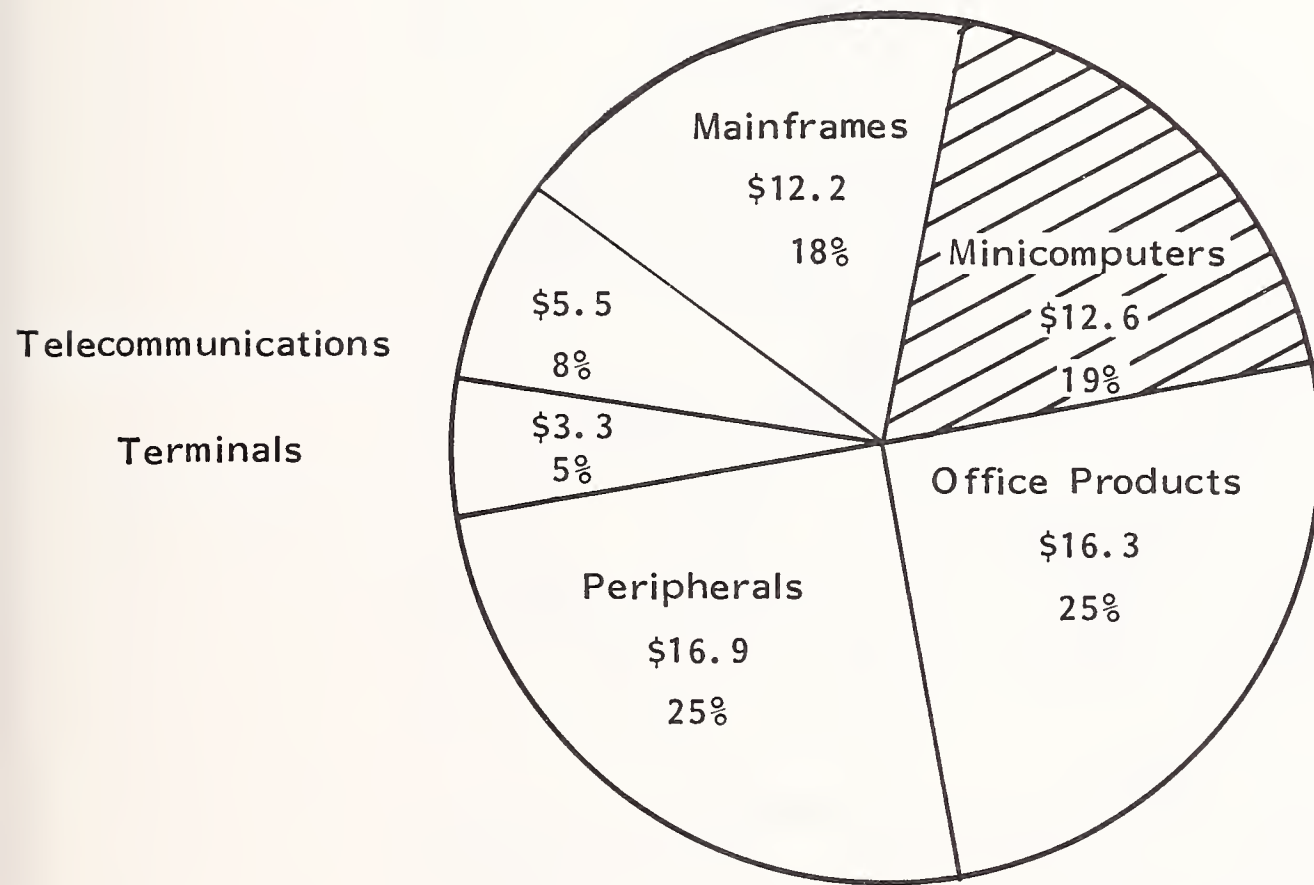
- Office Products. Growth in office products service will average 20% per year through 1989 making it the largest service market at the end of the decade. The tremendous growth in small business system/personal computer service (30% AAGR) will make this one of the most deceptively attractive service markets. Deceptive because there will be intense competition for this market with users opting for vendors that can provide a complete single source of service for all products at a user's office site.
- Terminals. While service on terminals will represent a \$1.8 billion market by 1989, vendors should be aware that this is a very price-sensitive market. Most of the 25% average annual growth rate in service will result from a vastly increased number of terminals being sold rather than from an increased profit margin. Users in this market sector are most likely (after PC users) to use TPM service and, if anything, users are likely to become more price sensitive as time goes on.
- Telecommunications. As noted above, this is the fastest growing service market segment with an average annual growth rate of 31% between 1984 and 1989. However, this is not a homogeneous market. In fact, the submarkets within telecommunications are very different and sharply defined markets with only one common characteristic--huge growth potential and excellent strategic value. The telecommunications market ranges from digital data switches to modems to earth stations to local area networks. Products in this market offer the advantages of high reliability (and therefore high margins) and, potentially, high volume contracts. On the other hand, competition from established telecommunication vendors (e.g., Northern Telecom, Bell Regional Operating Companies) will be intense and daunting to even the largest of the traditional service vendors.

2. EQUIPMENT SHIPMENTS AND THEIR EFFECT ON SERVICE

- Each of the service markets perform differently because, as noted in the previous section, there are different factors affecting each segment. There is, however, one factor which is important to all service market segments--the growth in product shipments. In some markets, mainframes for example, equipment growth has slowed and this is having a major impact on service service. Growth of personal computer shipments, on the other hand, can be directly traced as the cause of the vast increases in PC service revenue.
- INPUT projects that the total market for DP equipment (again, including mainframes, minicomputers, peripherals, office products, terminals, and telecommunications) will increase from \$67 billion in 1984 to \$125 billion in 1989--an average annual growth rate of just over 13%.
- Exhibits III-3 and III-4 provide a breakdown by product class of the DP market in 1984 (III-3) and 1989 (III-4). As the exhibits indicate, all product segments are gaining market share except for mainframes (falling from a 18% share to 14%) and minicomputers (19% to 16%). Cash product category is affected by different growth factors.
 - Mainframes. Shipments of traditional mainframes are expected to slow as a result of three factors:
 - Competition from superminicomputers, supercomputers, and distributed/networking systems.
 - Current saturation of traditional markets.
 - Higher levels of mainframe performance which result in reduced multi-system demand.

EXHIBIT III-3

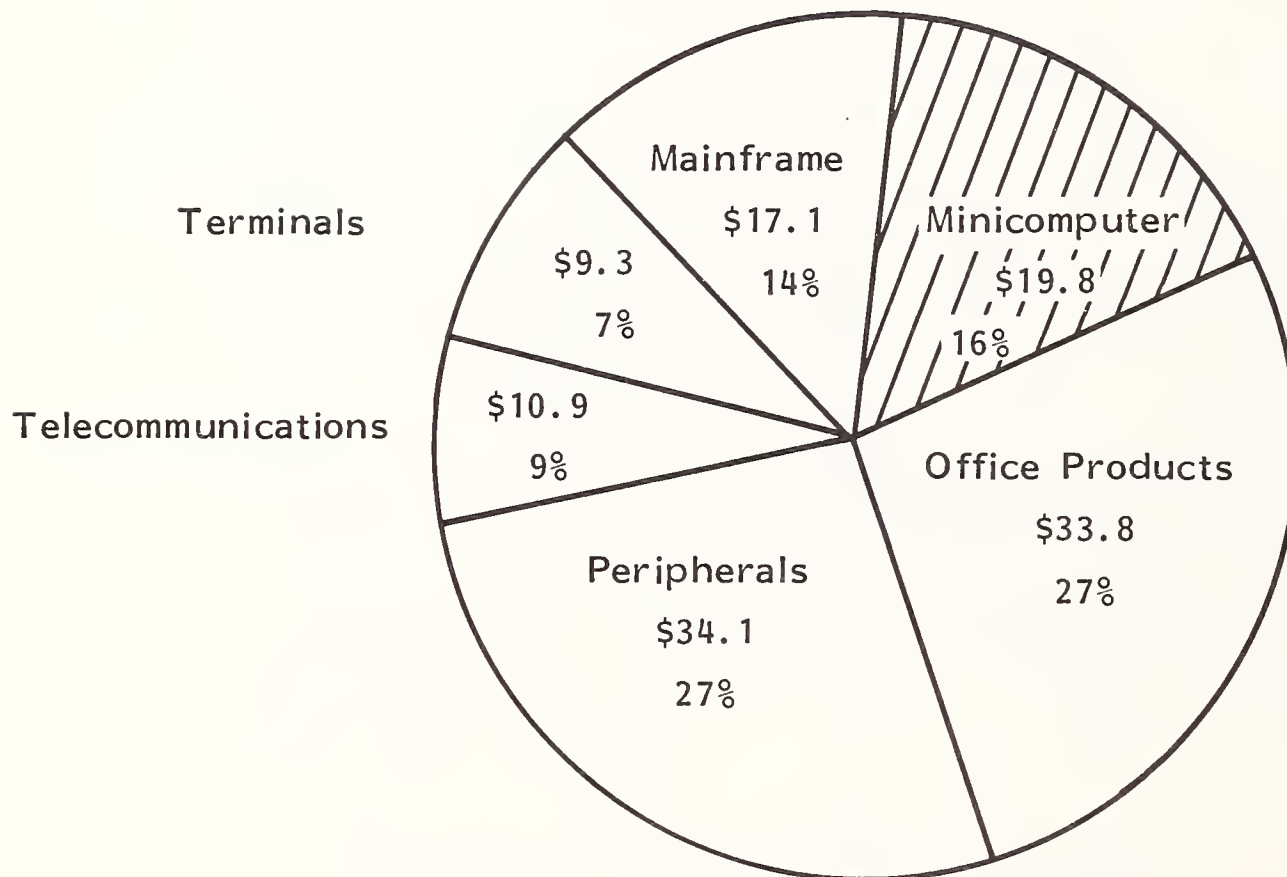
1984 DP EQUIPMENT SHIPMENTS
(\$ Billions)



Total Shipments in 1984: \$66.8 Billion

EXHIBIT III-4

1989 DP EQUIPMENT SHIPMENTS (FORECAST)
(\$ Billions)



Total 1989 Equipment Shipments (Forecast): \$125 Billion

- . Overall mainframe equipment revenues are expected to increase only 7% per year (AAGR) from 1984-1989.
- Minicomputers. This equipment segment will grow faster than mainframes (at 9.5% AAGR) but suffers from the same problems as mainframes: 1) competition from other market segments (notably super-micros and mid-range mainframes), and 2) saturation of their traditional markets. Growth of the superminicomputer subsegment is expected to far outperform the traditional 16-bit minicomputer market.
- Peripherals. This is the largest equipment market of them all. Peripheral shipments (although showing consistently strong growth over the past three years) must begin to slow now as local area and remote networks permit increased sharing of resources and lower levels of duplication. Price cuts also affect the shipment value.
- Terminals. Shipment growth of terminals is expected to share a rise due to steadily increasing functionality and higher quality/revolution of monitors demanded by a graphics-conscious business world.
- Personal Computers - Shipment values are expected to grow substantially slower than shipments because of the constant, sharp erosion of prices. The average configuration shipped in 1989 is expected to be valued at \$3,500 with more memory, more disk space, a higher resolution monitor, and a faster CPU than the 1984 configuration (which averages \$5,000). Overall, shipment value of PCs is expected to increase only 19% per annum.
- Office Products - The second largest shipment value by 1989 and an ideal candidate for sole-source maintenance contracts, the office products market is expected to show steady service revenue gains that produce more dollars than the peripheral service market. Office

systems (i.e., the integration of separate office functions through external linking of office products) will begin in the forecast period and assist in driving up revenue. The net result will be office product shipment value up almost 16% per annum to \$34 billion in 1989.

- Telecommunications. While this will be a high growth market (15% AAGR), shipment values will be impacted by sharp price cuts as new competitors enter the market. Shipment values will also be curtailed by long product life cycles.
- Although equipment sales have a direct impact on service revenue, INPUT has found that service departments are becoming less dependent on new equipment sales as the only method for increasing service revenues. Service vendors have been active in identifying new sources of revenue such as supplies sales, and add-on services (stand-by equipment, guaranteed uptime options, etc.). By generating increased after-sales support revenue, several of the largest vendors such as DEC have been able to increase overall revenues (primarily on the strength of service contributions) despite lagging equipment sales.
- The relationship between service revenue and equipment sales by market segment is demonstrated in Exhibit III-5. Mainframe vendors generate a much higher level of service revenue from total equipment sales than do other market segments for several reasons:
 - Mainframe users are typically less cost-conscious than small- or micro-based system users.
 - The mainframe service market is older and more firmly entrenched than other market segments--a greater variety of services are typically offered.

EXHIBIT III-5

EQUIPMENT SHIPMENT AND SERVICE REVENUE FORECASTS, 1984-1989

PRODUCT CLASS	EQUIPMENT SHIPMENTS (\$ Billions)			TOTAL SERVICE REVENUE (\$ Billions)			AAGR 1984- 1989 (Percent)
	1983	1984	1989	1983	1984	1989	
Mainframes	\$11.4	\$12.2	\$17.1	\$3.2	\$3.4	\$5.7	11%
Minis/SBS	11.1	12.6	19.8	1.6	2.0	4.1	15
Peripherals	13.7	16.9	34.1	2.2	2.5	5.2	16
Terminals	2.9	3.3	9.3	0.5	0.6	1.8	25
Personal Computers	3.1	3.7	8.9	0.4	0.5	1.8	29
Office Products	10.9	12.6	24.9	1.7	1.9	4.7	20
Telecommunications	4.8	5.5	10.9	0.6	0.7	2.7	31
Totals	\$57.9	\$66.8	\$125.0	\$10.2	\$11.6	\$26.0	17.5%

- Mainframe users require numerous support services in order to maintain high levels of system availability.
- Minicomputer manufacturers have been able to leverage service revenues although not to the extent accomplished by mainframe vendors. One of the main reasons that vendors are earning more service revenues per equipment dollar than in the past is the users' increasing dependence on their minicomputers. As with mainframes, a higher level of dependence typically translates into a higher demand for services and lower service price sensitivity.
- Personal computers--as a market segment--generate the lowest service revenue in relation to equipment sales. This is caused by several factors. First, the service market for PCs is not yet fully developed. Several manufacturers offer little or no service at all (they depend on TPM vendors). Even IBM only recently started offering on-site service.
- The second major reason why PC service revenue has not improved in relation to sales is that PC users have traditionally been very price-sensitive. Service revenue for the PC market segment is expected to soar as a result of the connection from the price-sensitive user of the past to the corporate, performance-oriented user of the future.
- Several revenues derived from telecommunications will suffer from the relatively long product life cycle and high degree of reliability of telecommunication equipment. Although service revenue will not increase substantially in relation to telecommunication sales, overall telecommunication service revenues will increase dramatically as a result of rapid telecommunication market expansion.
- Peripherals, and terminals service revenues will increase substantially in the next three to five years, but, like telecommunications, service revenue will not increase dramatically in relation to equipment shipped. There will be some additional service revenue derived from high product availability

requirements, but redundant/duplicate products will prevent unusually high service revenue growth (i.e., over and above normal increases resulting from new sales).

- Major increases in office product service revenue is likely as vendors begin to offer a greater variety of support services and as users become more dependent on their DP equipment. Although service revenue is 15% the size of office product sales today, by 1989 that figure will increase to 20%.

3. EFFECT OF THIRD-PARTY MAINTENANCE ON THE SERVICES MARKET

- Third-party maintenance in the computer industry is currently a \$11.4 billion a year business representing 10% of the overall service market. The largest TPM market sector, as shown in Exhibit III-6, is personal computers where TPM vendors control almost two-thirds of the market.
- TPM market penetration in personal computers has been caused, in large part, by two factors. First, because of large volume sales (particularly for systems like IBM and Apple), it is economically feasible to train technicians and stock parts. Second, most of the manufacturers had a "hands-off" attitude towards PC support and offered only the most marginal of services such as mail-in depot service. Although this is changing, many of the TPM vendors still offer better PC service than the manufacturers.
- The mainframe TPM market, discussed in greater detail below, currently controls about 5% of the overall mainframe service market. In many cases, TPM vendors are servicing obsolete systems which the manufacturers no longer support. Mainframe TPM vendors are, in a sense, providing service to both manufacturers and users.
- Minicomputers represent about 15% of the TPM market. As with mainframes, minicomputer TPM vendors service obsolete systems, but these vendors are also active in servicing current CPUs. Growing interest on the part of mini-

EXHIBIT III-6

THIRD-PARTY MAINTENANCE REVENUE AND MARKET PENETRATION BY PRODUCT SECTOR

MARKET SHARE	1984			1989		
	SERVICE REVENUE (\$ Billions)	TPM REVENUE (\$ Billions)	TPM PENETRATION (Percent)	TOTAL SERVICE REVENUE (\$ Billions)	TPM REVENUE (\$ Billions)	TPM PENETRATION (Percent)
Mainframes	\$ 3.4	\$.16	4.7%	\$ 5.7	\$.19	3.3%
Minicomputers	2.0	.17	8.5	4.0	.35	8.8
Peripherals	2.5	.23	9.2	5.3	.36	6.8
Terminals	0.6	.11	18.3	1.2	.31	25.8
Office Products	2.4	.37	15.4	6.5	.90	13.8
Telecommunica- tions	0.7	.10	14.3	2.7	.39	14.4
Total	\$11.6	\$1.14	9.8%	\$25.4	\$2.5	9.7%

computer manufacturers in sole-source maintenance will probably reduce TPM penetration in the next three to five years.

- Maintenance of peripherals is one of the most lucrative of the TPM markets (\$230 million in revenue in 1984) but it is also a market that will come under increasing pressure from manufacturers as the manufacturers promote sole-source maintenance.
- TPM penetration in the terminals market is expected to remain strong (17-18% of all terminals service revenue), due to the fact that TPM vendors can provide a generally faster turnaround time on terminals than manufacturers.
- The office product market (excluding PCs) does not hold a great deal of promise for TPM vendors. Currently, only 2% of the market is serviced by TPM vendors (\$40 million in 1984) and, because of manufacturers emphasis on single-source maintenance, it is unlikely that TPM vendors will be able to expand their market share significantly.
- TPM vendors are already making significant inroads in the telecommunication market with \$100 million in revenue, 14% of the total market. Although the TPM Market share will remain constant (at 14%), explosive growth in the telecommunications service market will make this market a major revenue producer for third-party maintenance vendors.

B. CURRENT SMALL-SYSTEM SERVICE MARKET

I. SERVICE REVENUE BY VENDOR

- Service on minicomputers is currently (1984) a \$2 billion market—an increase of 25% over 1983. This market typically includes the traditional 16-bit mini-computer and 32-bit superminicomputers.

- Minicomputer vendors, along with mainframe vendors, have been very successful at maintaining a high level of service revenue growth despite lagging hardware sales and declining service prices. As Exhibit III-7 shows, most small-system vendors have lowered service prices as a percent of purchase price since 1982. When the inflation rate is taken into consideration, this pricing trend becomes unanimous.
- One of the major reasons that small-system vendors can increase service revenues despite lower prices and slower than normal equipment sales is that the vendors are becoming more efficient in the services that they offer. There is a much greater use of remote support and telemarketing to service the customers and reduce the most expensive component of service--on-site service and sales calls.
- Another reason small-system vendors have increased service revenues is their growing flexibility in the number and type of services offered. Minicomputer vendors such as DEC, Data General, and Wang have opened new supplies and parts telemarketing groups which have been very successful. Other vendors are showing a similar level of flexibility in designing services to meet the users' needs rather than the service organizations capabilities. Users, in turn, are subscribing to new services proving that there are, in fact, substantial unmet service needs in the small-system market.
- Service revenues represent an increasingly important component of small-system vendor revenues, as demonstrated in Exhibit III-8. Services revenues range from a low of 9% of total revenue (for CDC) to a high of 31% for NCR. On average, small-system vendors derive about 19% of their total revenue from service related functions.
- Service revenues will continue to be an important component of small-system vendor revenues but performance will vary by vendor. As Exhibit III-9 demonstrates, 1984 service revenue growth will improve for most small-system

EXHIBIT III-7

SMALL-SYSTEM AVERAGE CONFIGURATION SERVICE PRICE TRENDS

VENDOR	PRODUCT	SERVICE AS PERCENT OF PURCHASE PRICE		
		1982	1984	△
CDC	480-II OME GA	8.2	7.0	(1.2)
Hewlett-Packard	3000/30	10.6	7.0	(3.6)
IBM	System 38/3-21	7.3	7.9	0.6
NCR	8150	12.6	9.7	(2.9)
Perkin Elmer	8/32	9.0	10.5	1.5
Prime	150/II	6.0	6.0	-
Wang	VS-100	12.8	9.1	(3.7)
Average		9.5	8.2	(1.3)

EXHIBIT III-8

SMALL-SYSTEM VENDOR SERVICE REVENUE, 1983

	Total Information Systems Revenue (\$ Millions)	Estimated Customer Service Revenue Worldwide (\$ Millions)	Customer Service Growth Rate 1982-1983 (Percent)	Customer Service as a Percent of Total Information Services Revenue 1983
Burroughs	\$4,390	\$1,073	4%	24%
Control Data	3,508	303	6	9
Data General	829	198	23	24
Datapoint	540	75	8	14
DEC	4,272	1,053	29	25
Hewlett-Packard	2,420	460	12	19
Honeywell	1,666	460	2	28
IBM	40,200	7,300	14	18
MDS/Qantel	364	102	16	28
NCR	3,731	1,171	8	31
Perkin-Elmer	214	35	8	16
Prime	517	125	47	24
Tandem	418	58	49	14
Texas Instruments	1,069	160	1	15
Wang	1,538	220	62	14

EXHIBIT III-9

SMALL-SYSTEM CUSTOMER SERVICE REVENUE GROWTH

VENDOR	1983 GROWTH (Percent)	PROJECTED GROWTH FOR 1984 (Percent)
Burroughs	4%	3%
Data General	23	25
Datapoint	8	19
DEC	24	30
Hewlett-Packard	12	16
IBM	20	27
MDS	16	18
NCR	8	10
Perkin-Elmer	8	8
Prime	47	24
Tandem	49	35
Wang	62	66

vendors. Wang will continue to be the high flyer in terms of service revenue growth with a 66% increase between 1983 and 1984. Burroughs on the other hand, will continue to suffer one of the lowest growth rates as a result of declining market share in small-systems.

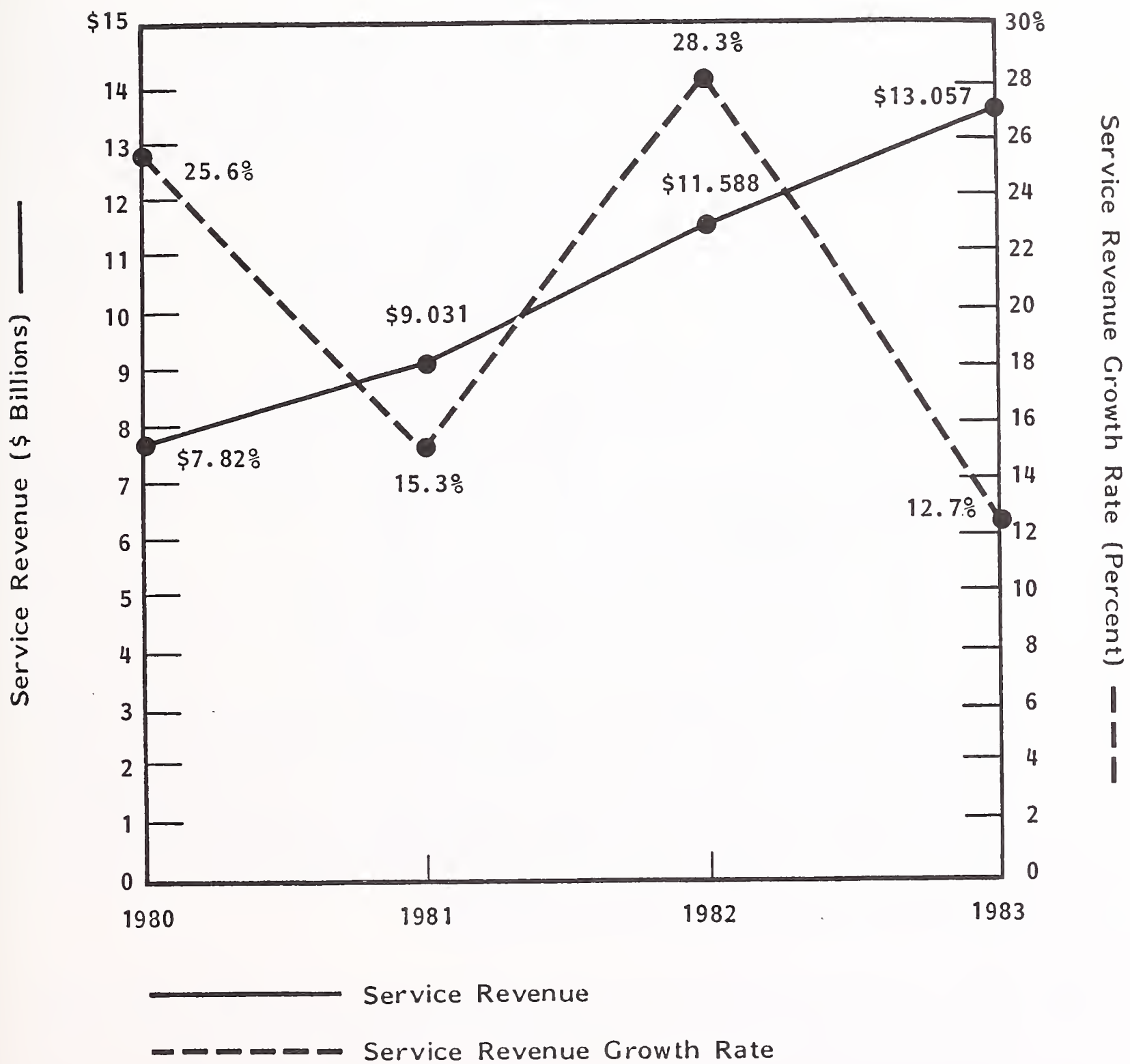
- 1984 should be an excellent year for most small-system vendors both in overall equipment sales and service growth. Exhibit III-10 demonstrates the relationship of service growth to overall service revenue for the top ten computer manufacturers over the past four years.
- One disturbing characteristic illustrated in Exhibit III-10 is the erratic fluctuation in service revenue growth from one year to another. This fluctuation has, in the past, been caused by the interdependence of service growth on hardware sales. Several vendors, such as IBM and DEC, have begun to reduce this interdependence so that service growth can be planned. Vendors that can plan for service revenue still experience significant variations in growth, but these variations are generally less severe and are improving.

2. CURRENT IMPACT OF THIRD-PARTY MAINTENANCE ON THE SMALL-SYSTEM SERVICE MARKET

- The small-system market in general is dominated by value-added resellers (VARs) and systems integrators that make use of (essentially) minicomputer processors to drive either specialized, dedicated hardware systems or application-specific software systems. DEC processors predominate, but large volumes of IBM, HP, Perkin-Elmer, TI, Data General, and Prime processors are used in this manner also.
- Few of these VARs actually service the hardware they sell, but they do provide software maintenance. This is a complication the user would rather do without--determining who to call for service is not always an easy task.

EXHIBIT III-10

WORLDWIDE SERVICE REVENUE GROWTH OF TOP TEN* COMPUTER MANUFACTURERS

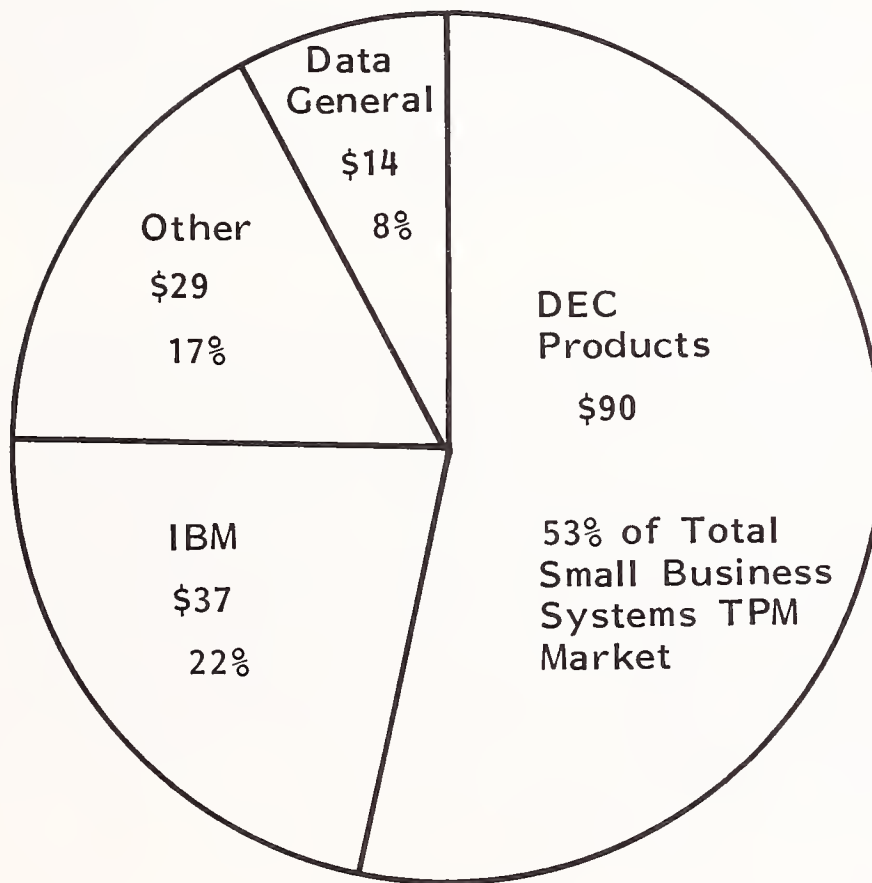


* Top Ten in 1983 include IBM, Burroughs, DEC, NCR, CDC, Sperry, Hewlett-Packard, Honeywell, Wang, Data General

- Currently, very few TPM vendors offer integrated maintenance (i.e., software, hardware, consulting, etc.) and consequently TPM penetration in this market is limited. A complete single source of maintenance has a strong attraction among both users and VARs, but it is an area dominated by manufacturers.
- The overall market for third-party maintenance on small systems is currently \$1.70 million--approximately 8.5% of the total small-system service market. Most of this revenue will be derived from single CPU sites particularly when the system is four or more years old.
- As shown in Exhibit III-11, the largest sector of the market is for DEC systems. This is due to:
 - The dominance of DEC equipment in the minicomputer market.
 - DEC's encouragement to OEMs and VARs to compose mixed-vendor hardware systems.
 - DEC's reluctance, until recently (fall 1983), to offer TPM services.
- Although TPM vendors have made a serious impact on DEC service revenues, INPUT expects a sharply reduced TPM growth rate as DEC begins to protect its installed base. This protection is coming in the form of increased support, by DEC, for non-competitive, non-DEC peripherals attached to DEC CPUs. In addition, DEC is strengthening its OEM service agreements in order to prevent customer base erosion from this group.
- IBM is currently protected, to some extent at least, by the user's high regard for the level and quality of IBM service. Customers are reluctant to use outside suppliers for anything, service included. In addition, IBM has priced its service very competitively, making it extremely difficult for TPM vendors to use price to gain access to the IBM market.

EXHIBIT III-11

1984 SMALL-SYSTEM TPM MARKET
(\$ Millions)



Total Small Business System TPM Market in 1984: \$170 Million

- Data General (DG) is the smallest of the three major minicomputer vendors seriously affected by TPM encroachment. Currently, there are over 60 TPM vendors offering service and supplies on DG equipment. Although DG's installed base can hardly support this vast TPM market, competition exists because users were not receiving the service they demanded. This may have resulted from DG's historic bias toward technical/engineering customers. The company expected its users to perform at least some of their own maintenance and consequently, service was not emphasized as highly as in other companies. When the company began to enter nontechnical markets however, service was an important requirement of users that could not be met by DG. Users naturally sought out TPM vendors in order to provide the required level of service.
- The various types of TPM services offered on small business systems is very similar to the services offered by the manufacturers except for the fact that manufacturers offer a more comprehensive, mixed-vendor level of service. Currently, this is not a real problem to TPM vendors because the manufacturers have not made a great deal of progress in developing sole-source maintenance programs. However, in the future users are likely to demand integrated, multivendor support—a service which will be extremely difficult for any but the largest TPM vendors to offer.

C. 1984-1989 FORECAST FOR THE SMALL-SYSTEM SERVICE MARKET

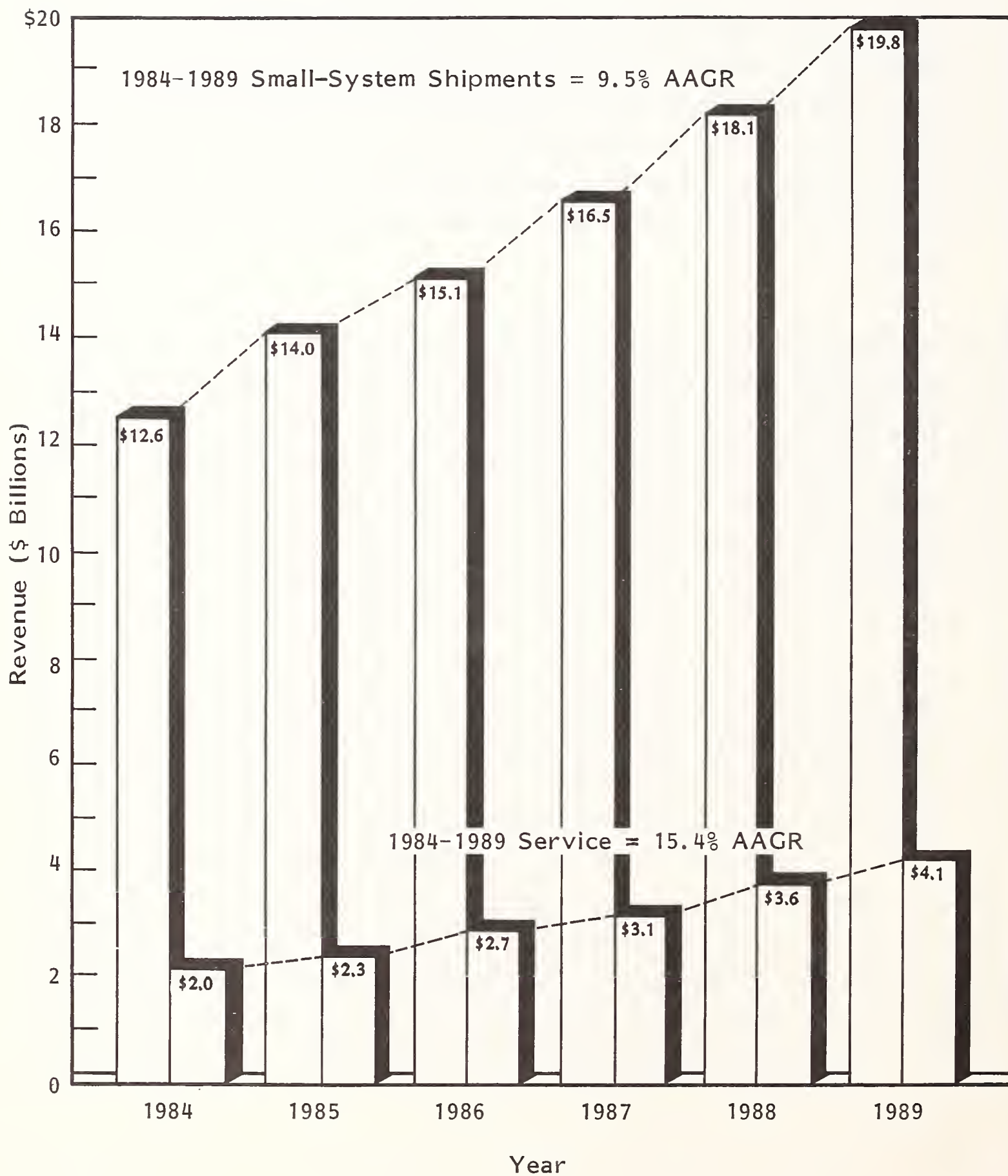
I. SMALL-SYSTEM SERVICE REVENUE GROWTH 1984-1989

- The small-system service market is currently growing at over 20% per annum but INPUT expects this rate to slow to 15-16% average annual growth between 1984 and 1989. Service on small systems will generate over \$4 billion in revenue by 1989.

- Although the overall growth rate for service will decline somewhat in the next five years, it will continue to maintain a better track record than small-system equipment shipments which are expected to grow at an average rate of under 10% through 1989.
- Exhibit III-12 demonstrates the growing importance of service revenue in the small-system market. In 1984, service revenues represented just under 16% of total equipment sales, but by 1989, this number is expected to increase to almost 21%. Many of the leading small-system vendors, such as DEC, DG, and Wang are placing new emphasis on service as a way to improve bottom-line growth and INPUT expects this trend to continue through the end of the decade.
- The relatively slow growth of small-system equipment shipments (10% AAGR through 1989) will take its toll on service growth. This is as much a function of an incipient slowing of unit shipments as it is of the constant erosion of mini and small business system shipments. In many areas, the micro is doing to the mini what the mini did to the mainframe. Small-system service vendors will be forced to be very creative and flexible as the user base of mature 16-bit machines begins to become more service-sensitive.
- Although the overall small-system service market is expected to grow at moderate rates from 1984-1989, individual companies will perform at drastically different levels. One important factor which will affect service revenue growth is a viable product line that can support a wide variety of small-system user needs. Small-system vendors differ dramatically in this area:
 - DEC has its very popular VAX series of superminis that extend all the way down to the Micro VAX. This series offers tremendous revenue potential, but at the very top end users are waiting for more power and at the bottom end, DEC's PC plans seem muddled. With their traditional PDP being attacked by supermicros, DEC must address the low

EXHIBIT III-12

SMALL-SYSTEM MARKET GROWTH RATES BY YEAR



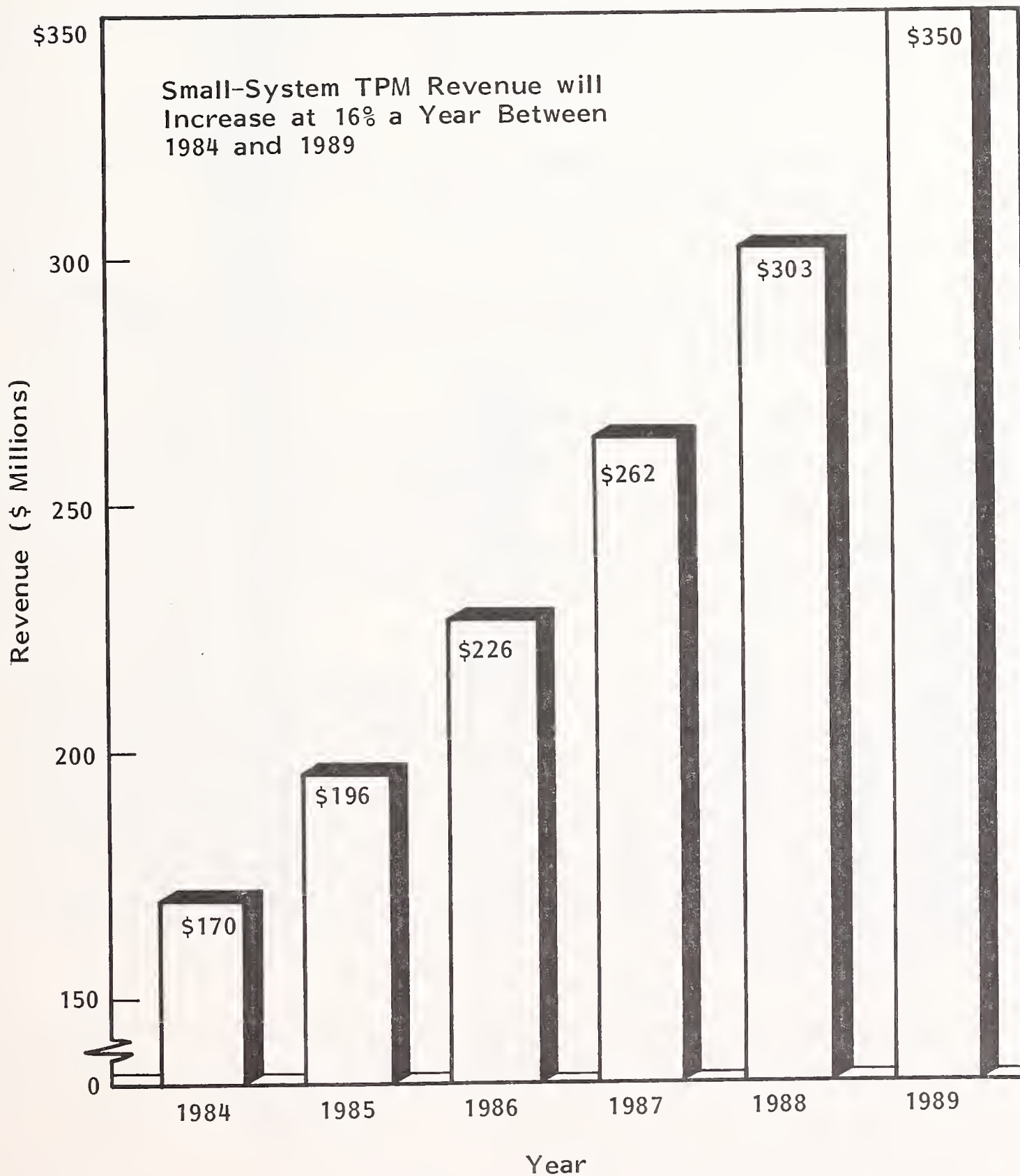
end of the market if revenues based on equipment sales are to continue to grow.

- Data General has spent most of its time and energy lately upgrading its top-end MV-series of superminis. Like DEC, this flagship series supermini has been very influential both in equipment sales and service revenues. But, also like DEC, DG is feeling the pinch of supermicrocomputers at the low end of their traditional mini line. If the company can make the transition away from a technical/scientific base (now using NOVAs, CS, and Eclipse machines) and into the commercial market (with Desktop Generation PCs, and low-end Eclipse), continued high levels of service growth are expected.
- Wang is a company that has overcome serious service problems with the help of a booming market, a vast array of products and a management group dedicated to improving service. The company has one of the most complete product lines in the small-system market. This will be instrumental in maintaining high service growth rates in the late 1980s.
- Companies such as Burroughs, Honeywell, and Datapoint will experience below average service growth rates in the next five years primarily as a result of the lack of new small-system products. Both Burroughs and Honeywell seem to have redirected their priorities toward the mainframe environment while Datapoint has just started to overcome a disastrous period in the early 1980s. In all three cases, the number of new products introduced by the companies has been limited and this will have a direct adverse effect on service growth.
- Besides new products, there will be a variety of other factors which will affect growth of the small-system service market. While micro- and supermicrocomputers will continue to penetrate the low end of the market, compatibility within an entire line of minicomputers (e.g., the DEC VAX series) will be a strong selling point to users who expect expansion capabilities. In addition, the inherent instability of the PC market will be an advantage that small-system vendors will exploit.

- Small-system vendors are targeting a variety of high growth markets such as CAD/CAM and office automation. The vendor's success in penetrating these markets will be a key determinant to overall growth. Of course, it is likely that the major small-system vendors such as IBM, DEC, DG, Prime, etc. will be most successful in entering the high growth markets.
2. IMPACT OF THIRD-PARTY MAINTENANCE ON SMALL-SYSTEM SERVICE, 1984-1989
- TPM vendors currently earn about 9% (\$170 million) of the total small-system service market (1984: \$2 billion). Exhibit III-13 demonstrates that TPM revenues will increase in absolute numbers to \$350 million in 1984, but there will be no change in the TPM vendors' market share, which will remain at just under 9% of total small-system service revenues.
 - TPM vendors will make their largest gains in the traditional 16-bit minicomputer market particularly in high-density machines such as the DG NOVA and CS series, and the early DEC PDP series. TPM vendors will seek out these products for several reasons:
 - The installed base is quite large and offers high density user populations.
 - Parts are available from a variety of sources including the manufacturer, salvaged products, and after-market manufacturers.
 - Because the products are often quite old, the original manufacturer has usually raised service prices to a level that TPM vendors can undercut and still make a profit.
 - In contrast to the older, 16-bit machines, TPM vendors will have a difficult time penetrating the market for newer 32-bit superminicomputers. Since the

EXHIBIT III-13

SMALL-SYSTEM TPM FORECAST, 1984-1989

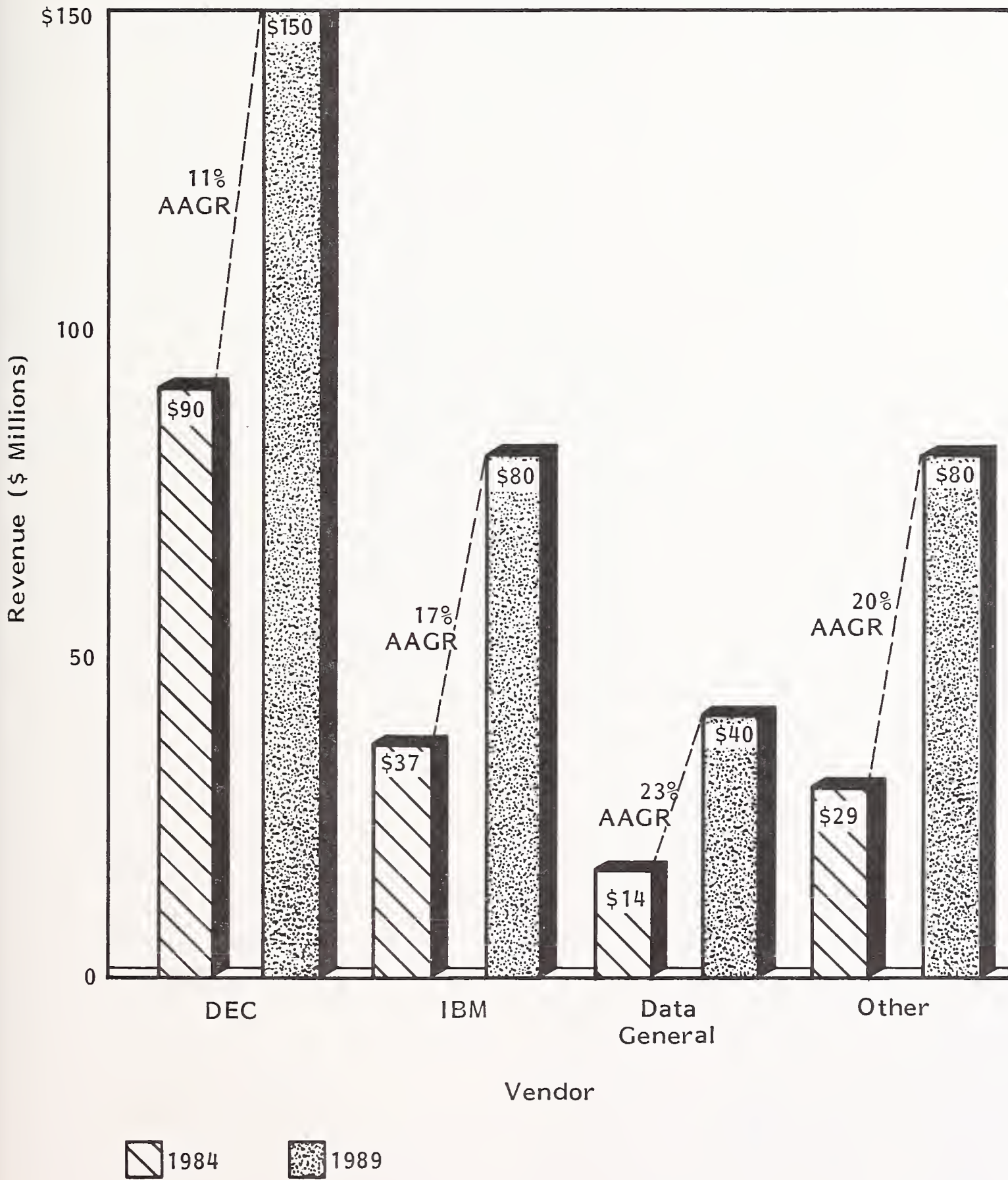


32-bit machines represent the fastest growing portion of the market (by far), being excluded from this submarket will hold down small-system TPM growth rates to 16% through 1989 while they normally would have risen to substantially over 20%.

- Small-system vendors will attempt to protect their installed base in a number of ways:
 - Service prices will become much more competitive thereby removing price as an advantage for TPM vendors.
 - Remote diagnostic and support routines will be developed by the manufacturers to improve service efficiency.
 - Manufacturers will stress the value of an integrated, single source of support—a service that only the largest of the TPM vendors can offer.
- As a result of the manufacturers' efforts to curtail TPM penetration, INPUT expects a significantly different TPM market in 1989 than is seen today. Exhibit III-14 demonstrates that TPM penetration of the DEC market will slow considerably while Data General and "other" small-system vendors will experience sharply higher levels of TPM activity.
- Certain vendors will be more susceptible to TPM pressure than other vendors because they cannot or choose not to meet user requirements for service. Small-system users have indicated that hardware features, such as high levels of uptime, response time, and repair time are the most important components of service they are looking for from both manufacturers and TPM vendors. Software support is currently not as important to users as hardware support, but this will change.
- It is likely that TPM vendors will continue to stress price and convenience as the two major advantages of third-party maintenance. Price, the historical

EXHIBIT III-14

SMALL-SYSTEM TPM GROWTH BY VENDOR, 1984-1989



* Average Annual Growth Rate

basis for TPM existence, will become less and less important as users become less price sensitive and require more integration on services. Currently, TPM vendors have an advantage over manufacturers in that the TPM suppliers have been forced to cater to user needs. However, as user needs become more and more substantial, many TPM vendors will not have the resources to meet user requirements for service. As this situation progresses, manufacturers with more substantial resources will begin to take market share away from the TPM vendors.

IV PRODUCT ANALYSIS BY VENDOR

IV PRODUCT ANALYSIS BY VENDOR

A. BURROUGHS CORPORATION

- Burroughs is normally thought of as a mainframe vendor because most (over 50%) of its revenue is derived from this market segment. The company is, however, a major player in the minicomputer market as well, with over \$900 million in revenues in 1983, placing Burroughs behind only IBM and DEC as a leader in this market.
- Despite the fact that Burroughs is a well established competitor in the minicomputer market with huge resources to draw on (\$4.4 billion total revenues in 1984 and a total user base of over 40,000 customers), the company's progress in the minicomputer market has not been exceptional. There are several reasons for this lackluster performance:
 - The minicomputer industry as a whole has been hurt by economic conditions more than other computer market segments.
 - The emergence of new competitive products (superminis and super-microcomputers) have placed a great deal of competitive pressure on Burroughs' traditional minicomputer product line.
 - IBM has become much more aggressive in the minicomputer market.

- There is little that Burroughs can do about economic conditions except to make the best of a bad situation. As the analysis of other minicomputer vendors indicates, the recession hurt almost everyone. In fact, Chairman W. Michael Blumenthal has succeeded in turning around the company's internal operations resulting in significantly improved financial performance. It is in the more important areas of product and competitive strategy however, that the company has not performed well.
- Unlike many of the other companies in the industry, Burroughs has not diversified to any great extent. The company is particularly dependent on mainframe revenues and it is the aspect of the industry that seems to drive the company's entire planning effort. In order to survive in the mainframe market, Burroughs has chosen to concentrate on specific markets--to offer a "total solution" in terms of products and support. This may not be the solution to the company's problems in the minicomputer market.
- While Burroughs has clearly focused on what it knows best--the mainframe market--its minicomputer markets are slipping away. In 1983, for example, Burroughs introduced or started to ship four new mainframe products, but only one minicomputer (the B1990). In addition, despite a tremendous growth in the office automation market only one CPU aimed specifically at this market (the B95) was forthcoming from the company.
- There appears to be a substantial reluctance on the part of management at Burroughs to enter the fast growing personal business computer/office automation market. It may be the lack of directions of the market that prevents Burroughs from devoting more attention to the office automation market, but INPUT believes that no minicomputer vendor can succeed in the long run without access to office automation revenues.
- Superminicomputers represent another aspect of the market which is being neglected by Burroughs. Currently, this is one of the fastest growing minicomputer segments, but Burroughs has no products to compete effectively against the DEC VAX or Data General MV series, to name just a few.

- In terms of service, Burroughs' minicomputer strategy will have several ramifications:
 - The installed base is relatively old. The B-90 series, for example, was first delivered in 1979. Service rates on these older machines are higher than the generally more reliable current generation of minis.
 - There will be increasing TPM competition--usually based on price--for maintenance on Burroughs minicomputers.
 - If Burroughs continues to neglect high growth markets such as PCs, its user base could be eroded by full product line vendors resulting in lower overall maintenance revenues.
- Burroughs' current minicomputer product line can be divided into three basic groups: B90, B900, and B1900.
 - The B90 series is the company's entry level mini. Originally introduced in 1979, this series now has five models: B91, B92, B93, B95, and B96.
 - The top end of the B90 series is the B96. It can be configured with up to 1.5 M-bytes of memory and 231 M-bytes of disk storage. The B90 series can accommodate from one to 12 workstations.
 - The major advantages of the B90 series is its upward compatibility with larger minis such as the B900. The age of the system (and its impending obsolescence) is the system's major disadvantage.
- The B900 is Burroughs' midrange minicomputer with a main memory capacity of up to 3.3 M-bytes and capable of handling up to 36 workstations.

- The B900 was originally announced in 1980 and was designed with both standalone and distributed processing applications in mind. The B920 features a multiprocessor architecture that provides the user with a certain level of redundancy thereby enhancing system availability.
- The key advantages of the B900 series are its upgradability to the B1990 series and its high level of proven system availability.
- Although the B1900 was originally introduced in 1979, it is the most recently upgraded system featuring the B1990 introduced in 1983. The system has a capacity of up to 2 M-bytes of memory and over 3000 M-bytes of disk space.
 - The B1900 series represents a significant advance over the earlier B1700 and B1800 series in that it utilizes TTL (Transistor-Transistor Logic) to enhance system reliability.
 - The B1900 is, however, compatible with both earlier systems and with the B90 and B900 systems.

B. DATA GENERAL

- Data General made very substantial gains in the late 1970s based primarily on sales of 16-bit minicomputers to scientific and technical markets. Total revenues during this period increased 30-40% annually with net income growing in the 20% (annual) range. Unfortunately, by concentrating on its traditional market, DG neglected high growth opportunities, such as super-minicomputers and microcomputers, which would have a tremendous impact on the company's growth in the 1980s.
- Total revenue in 1983 was \$829 million, an increase of only 3% over 1982, while net income fell 6% to \$23 million in 1983. Revenues were adversely

affected by two factors at DG: first, increased R&D and capital expenditures needed to develop new lines of superminicomputers and PCs and second, a new marketing philosophy emphasizing office automation in addition to DG's traditional data processing and technical/scientific markets.

- The company's new product and marketing strategy appears to be working--net earnings for the third fiscal quarter of 1984 increased to \$16.1 million, up from a net of \$4.3 million for the same period in 1983. Total revenue for the first three quarters of 1984 was up 33% to \$475 million compared with \$557 million in 1983.
- INPUT estimates that Data General's total revenue for fiscal 1984 will equal \$970 million--a 17% increase over 1983.
- The transition away from Data General's traditional minicomputer market to faster growing markets will benefit the company in the long run, but as indicated above, short run profitability will be reduced. In order to maintain acceptable revenue growth levels, Data General management has become increasingly dependent on customer service to fuel bottom-line growth.
- Service revenues have increased substantially from \$126 million in 1981 to nearly \$250 million (INPUT estimate) in 1984--an almost 100% increase in just four years. In addition, field service revenues are growing as a percentage of total revenues, from 17% in 1981 to an estimated 26% in 1984.
- Field service managers at Data General attribute the increase in service revenues to a number of factors, one of the most important of which is increased efficiency within the service group. Paul Phaneuf, director of marketing and business planning for Data General's customer services organization, has indicated that the financial drain in setting up a service network has been virtually eliminated and the company can use service revenue for improving and streamlining the organization.

- The current service network which Mr. Phaneuf alludes to is the service group established to maintain the company's 16-bit minis which represent by far the majority of DG's installed base. These traditional minis include the Eclipse S/series and the Eclipse C/series.
- The Elipse S/280 is the top end of Data General's 16-bit minicomputer line. it can have up to 2 M-bytes of main memory and 5.6 Gigabytes of disk storage. The S/280 can support up to 64 workstations and is aimed primarily at engineering and process control markets.
- The C/30 is the company's latest addition to the Eclipse line and was introduced in 1983. Like the S/280, the C/30 can support up to 2 M-bytes of main memory, but can access only 150 M-byte of disk storage. The C/30 is limited to 16 workstations.
- In addition to standard programming languages, such as FORTRAN, and PL/I, DG has developed software (called the Comprehensive Electronic Office) to facilitate office automation functions. These functions include word and data processing, communications, and decision support.
- Both the S/ and C/ Eclipse computer lines face stiff competition from established competitors such as IBM, DEC, and HP. One of the primary advantages of the 16-bit Eclipse series is its compatibility with DG's 32-bit MV series of superminicomputers. This compatibility ensures an upward mobility path that no other competitor can match.
- Two of the older minicomputer lines from DG which continue to have an impact on the service market are the CS family of 16-bit machines and the popular NOVA series. Both of these lines are being phased out in favor of the Eclipse series, but both have a large installed base and represent a substantial portion of the company's service revenue.

C. DATAPoint

- By all odds, if one minicomputer company should be succeeding today, it is Datapoint. They were one of the pioneers in local area networks--at a time when other computer vendors did not even acknowledge the importance of the market. By the early 1980s, Datapoint had installed thousands of ARCNET systems (the company's LAN) and should have had an inside track in the race for office automation market share. Instead, growth is stagnating and the public's interest in the product and company is lagging.
- A number of factors contributed to Datapoint's current plight. First, although the company had a technological lead in the 1970s, by the early 1980s its 8-bit machines were being surpassed by competitors eager to enter the LAN market.
- A second factor which led to Datapoints' lackluster performance was the company's decision to expand its direct sales force as a means of reducing its dependence on OEMs. Since acknowledging the problems of the past, Datapoint has begun a modest turnaround. 1983 revenues were \$540 million with net earnings of \$13 million--a substantial improvement over 1982. So far in 1984, the company continues to register respectable (14%) growth figures.
- The turnaround at Datapoint is primarily the result of the company's going back to basics--Local Area Networks. There is little interest now in large scale PBX development and the heavy drain of the communications management products division has been stemmed. Unfortunately, the company is in desperate need of a revitalized product line.
- Datapoint currently offers four processors (the 1560, 6600, 8600, and 8800) and has recently contracted with Convergent Technologies to sell a private label version of the 16-bit N-Gen personal computer. By today's standards, these systems are outmoded; the 6600, for example, was originally introduced

in 1977. Although Datapoint is trying to correct the problem new products are not yet available (the company went for almost a year in 1983/84 without introducing any new products.)

- The 1560 is an entry level 8-bit system with a capacity of up to 128 K of main memory and 40 M-bytes of disk storages. The 1560 can support up to three workstations.
- The 6600 is also an 8-bit system, but is substantially larger than the 1560. The 6600 can support up to 24 workstations and has a main memory of up to 256 K. Datapoint claims to have over 15000 6600 systems installed since their introduction in 1977.
- The 8600 machine can be configured with up to 512 K of memory and can support up to 12 workstations. However, like the 1560 and 6600, the 8600 is an 8-bit machine. The 8600 does have the advantage of being upgradable to the top-of-the-line 8800.
- Datapoint's top processor is the 16-bit 8800 introduced in 1980. The 8800 comes configured with up to 1 M-byte of main memory and 1000 M-bytes disk storage. Up to 24 workstations can be connected to the 8800.

D. DIGITAL EQUIPMENT CORPORATION

- The traditional 8- and 16-bit minicomputer is DEC's stock-in-trade. The company grew from virtually nothing to over \$1 billion a year primarily on the strength of its PDPs, and Datasystem's products. Although the VAX 11/700 series of superminicomputers is now the major revenue generator, the current PDP 11/XX is still a strong contributor to bottom-line growth.

- The big question is what happened to DEC in the early 1980s and did the traditional minicomputer market have anything to do with it? The answer of course cannot be absolute. Sales of the traditional minicomputer (16-bit) have indeed been affected by supermicro and supermini sales. DEC was late getting into the 32-bit supermini (in 1977, behind Prime and Perkin Elmer), but since its entry into this market, sales have been booming.
- While some other vendors have dropped most of their 16-bit mini products, DEC's PDP line is still selling moderately well. In part, this is a reflection of the high standing in which their customers hold DEC. It is also an indication of DEC's loyalty to its user base--the company has continually upgraded the product since its original introduction over five years ago. The latest upgrade, the PDP 11/73 (discussed below) was announced in November 1984.
- Despite the stability of the minicomputer line and overwhelming popularity of the VAX, DEC's revenue growth has been falling precipitously since the early 1980s. In 1981, for example, total revenue growth was 35% per year, but that number dropped to 10% by 1983.
- There are numerous causes of DEC's malaise:
 - Competitive "supercomputers" such as IBM's PC AT cut into the traditional minicomputer market.
 - DEC's own personal computer strategy was not well focused or directed in a marketing sense.
 - The company's aging VAX 11/780 series is still draining the traditional 16-bit minicomputer market, but its top-end growth is limited. Current users are waiting for the next generation of supermini after the 11/780.

- DEC announced that the popular System-10 and System-20 mainframes would not be upgraded and that users of these machines were advised to begin the costly migration to VA products.
- Despite all of these problems, DEC continues to be the major force in the minicomputer market. And with projected 1984 revenues of over \$5 billion, DEC will continue to dominate this market. Simply as a function of its size, DEC will participate in most, if not all, computer markets. INPUT expects the company to emphasize the PC and supermini markets, but the traditional PDP line will also receive periodic upgrades.
- The DEC PDP 11 is a line of 16-bit minicomputers introduced in the mid-1970 and currently consisting of five basic models: Micro/PDP-11, PDP 11/23-plus, PDP-11/24, PDP-11/44, and PDP-11/73.
- The Micro/PDP-11 and PDP 11/23 are low-end systems designed to offset microcomputer sales to potential minicomputer customers. These systems are typically priced in the \$10,000-\$15,000 range but are capable of controlling up to six (Micro/PDP 11) or ten (11/23) users. The main memory is expandable up to 4 M-bytes and can be configured with up to 40 M-bytes of disk storage.
- The PDP 11/24 is a midrange system which was introduced in February, 1981. Like the 11/23, the 11/24 can support up to ten current users and can be configured with up to 4 M-bytes of main memory. In addition, the PDP 11/24 can support up to 3.6 gigabytes of disk storage.
- Formerly the top of the PDP 11 line, the 11/44 is similar in many respects to the 11/24. However, the 11/44 supports up to 48 workstations (as opposed to ten for the 11/24).
- The PDP 11/73--the new top end of the PDP line--was introduced in late 1984. DEC has indicated that the 11/73 provides up to five times the power of the 11/23 and is equivalent to the 11/44, only at a significantly lower

price. (The CPU with 512 K-byte of main memory is priced at \$7,800.) The 11/73 can support up to 14 terminals.

- The real advantage of the PDP line is its versatility and flexibility. DEC has ensured peripheral compatibility, for example, in order to promote the migration to VAX products. In addition, users have a choice of up to 8 operating systems (10 for the 11/73) which are compatible with various PDP 11 product models.
- Perhaps the most significant advantage of the PDP line is its huge installed base and add-on product listing. Although the PDP may be one of the originals in the true 16-bit minicomputer market, constant upgrades and users' acquisitions of these upgrades make this a very attractive, stable market for DEC to pursue.

E. HEWLETT PACKARD

- Hewlett Packard is one of the founding fathers of Silicon Valley and although it is over 40 years old and \$4 billion strong it continues to grow and enter new markets regularly. The company started by building test equipment, but currently derives over 50% of its total revenue from computer related sales.
- Until recently, HP was a traditional engineer-run company. The company introduced its first minicomputer in 1968, and initiated its workhorse HP 3000 in 1972. The 3000 continues to be the backbone of HP's product line although other 16-bit products, such as the 250 and 1000, have also been added.
- Unlike many of its competitors, HP has not yet introduced a full 32-bit superminicomputer system. The HP 9000, a 32-bit workstation, is seen to be the company's first step in this market and INPUT expects a complete 32-bit system to be available by late 1985 or early 1986--ten years after the first superminis were introduced by Prime and Perkin Elmer.

- It is difficult, however, to find fault with Hewlett Packard. While other minicomputer vendors struggled and lost market share in the early 1980s, HP just kept growing. While fiscal 1983 growth was not spectacular (12%), the last calendar year growth has been well over 20%.
- One of the reasons HP's revenue growth is back on track is the company's growing emphasis on the personal computer market. In making this decision, HP is definitely marching to a different drummer than DEC, Prime, and other minicomputer vendors who have not emphasized PC development. HP feels, however, that success in the PC market is essential to the success of the overall company.
- The HP 150 is the company's latest attempt to enter the retail PC market. Unfortunately, the 150 has not been as popular as expected, possibly due to its price and incompatibility with the IBM PC. But HP has also introduced a number of successful products such as the portable and Thinkjet printer.
- In addition, the Palo Alto based company is becoming much more marketing oriented in order to understand the market's PC needs. The company is trying traditional market research techniques such as using focus groups and test marketing. The number of retail stores carrying personal computer products has doubled to over 600 and recently an entire shopping mall in California was leased by HP in order to house its marketing group.
- The company's emphasis on personal computers should not be viewed as separate and apart from their traditional minicomputer market. HP clearly plans to merge these two product lines into a unified assault on the office automation market.
- But how will HP's line of minicomputers fit into the company's new strategy? Undoubtedly, the company plans to continue the refinement of the 3000 and development of the 9000. Like DEC's Micro/PDP-11, HP has introduced the

3000 series 37 to fight off supermicrocomputer competition. At the high end the 3000 series 68 has performance characteristics similar to and even better than some superminicomputers.

- As noted above, the HP 3000 series was introduced in 1972 and as such it is one of the oldest surviving designs still in production. There are currently five models within the 3000 line: Series 37, Series 39, Series 42, Series 48, and Series 68.
 - The Series 68 is the top-of-the-line HP 3000. The 68 can be configured with up to 8 M-bytes of main memory and has a performance rating of 1-1.6 mips. The 68 can support up to 400 users.
 - The Series 48 is a mid-range 3000 capable of supporting 152 users. The 48 can be expanded to 4 M-bytes of memory, and supports 4.2 gigabytes of disk storage. The Series 42 offers a similar performance rating to the 48, but can support only 92 users.
 - The Series 37 was, until recently, the entry level 3000 with a minimum configuration of 512 K (expandable to 3 M-bytes). Although the 39 is still available, the Series 37 has replaced it as the lowest cost, entry level 3000.
 - The 37 is ideally suited to HP's continued expansion into the office automation market. The 37 is inexpensive (less than \$20,000), it requires little or no environmental control and can support up to 28 terminals.
- Despite the fact that the HP 3000 was introduced in the early 1970s, it has continually been enhanced and upgraded. In addition, because the operating environment has not changed, application programs are compatible throughout the model line. Another major advantage of the HP 3000 is the tremendous selection of software available in the 3000.

- The HP 1000, like many Hewlett Packard products, is aimed at the scientific/technical and industrials markets--specifically at the automation of manufacturing and industrial companies. Maximum memory ranges from 1.5 M-bytes-4 M-bytes with up to 10 gibabytes of disk storage.
- The HP 250 is similar to the HP 1000 in that it is aimed at a specific market, however, the 250 is designed for small business users. The system supports up to ten workstations and can be configured with up to 896 K of main memory and 250 M-bytes of disk storage.

F. HONEYWELL INFORMATION SYSTEMS

- Like many of the other "bunch" vendors, Honeywell is primarily a mainframe vendor that entered the minicomputer market in order to maintain a full product line. While Honeywell was successful with their multi-product strategy in the past, increased competition may force a strategic reconsideration.
- Although Honeywell Information Systems (HIS) earned \$1.7 billion in 1983, revenue growth since 1980 has been flat. In addition, the company derives only 20% of its revenues from its minicomputer products.
- The company has indicated that it will try to combat problems relating to small market share and increased competition (both in mainframes and minis) by working more on software solutions and reducing in-house hardware development. While this strategy may be appropriate with large mainframes (where NEC can supply newly developed mainframes), it is unlikely that the company will find any manufacturer willing to develop new products for the 16-bit minicomputer market.

- Honeywell's line of minicomputers, the DPS 6, has suffered in the 1980s as a result of lack of software and an inadequate sales strategy. The company has clearly recognized these problems and, considering their substantial installed base of minis, a solution-based sales strategy could be very effective in improving bottom-line profitability.
- The DPS 6 is Honeywell's only major minicomputer at this time. This line is produced for both end users and OEM vendors--through six major models it spans the minicomputer market from the low-end, microcomputer-like 6/10 up to the most powerful 16 M-bytes 6/95.
 - The DPS 6/95 is a 32 bit minicomputer with a capacity for up to 16 M-bytes of main memory and 4 gigabytes of disk storage. The 6/95 can support up to 112 users and is field upgradable from less powerful (16-bit) 6/45 and 6/75 minis.
 - One key advantage to the entire DPS 6 line of minis is the compatibility of the GCOS operating system which provides users with a clear migration path from the smallest to the largest model in the DPS 6 product line.
 - The DPS 6/75 is considerably less powerful than the 6/95 and is capable of .56 mips as opposed to 1.8 mips for the 6/95. The 6/75 has one or two M-Byte of main memory, can support up to 96 users and has a disk storage capacity of up to 2 gigabytes.
 - The DPS 6/45 is the low end of the DPS 6 upgradable minis. The 6/45 can be upgraded to either the 6/75 or 6/95 and as a standard is limited to 1 M-byte of memory and 32 workstations.
 - The DPS 6/10, 6/20, and 6/40 are entry level, general purpose minicomputers. They are all 16-bit machines, but cannot be field upgraded to any more powerful system. The 6/40 has by far the greatest

capacity of the three with a performance rating of 0.4 mips, 1 M-byte of main memory and the capability of handling up to 28 workstations.

- The DPS 6/10 is at the low end of the line and is likely to be most affected by microcomputer competition. The 6/10 has a maximum memory capacity of 512 K and can support only two workstations. As noted above, however, data compatibility with other DPS 6 machines is ensured when using GCOS system software.

G. IBM

- Although IBM may have missed a very substantial opportunity when they delayed their entry into the minicomputer market, they did not drop the ball altogether. Today, IBM earns more money from minicomputers than any other vendor except DEC. Although minicomputer revenues represent less than 10% of IBM's total revenue, the company earns over \$3 billion from this market.
- IBM has taken an interesting approach to the minicomputer market. On the one hand, the company is squeezing the market by emphasizing its traditional strength in mainframes and its newly developed dominance of the supermicro-computer market. At the high end, the Armonk-based company has introduced products like the 4300 which are price competitive with the minicomputer market and yet offer the performance characteristics of a mainframe. At the low end of the market, IBM is expanding its already substantial line of PCs to include networked and workstation-based systems.
- While IBM is squeezing the minicomputer market with its micros and mainframes, it is also increasing its competitive stance in the market. The company is becoming much more aggressive, particularly in the area of new product development. The system 36--the long awaited replacement for the System 34--appears to be an overwhelming success. IBM has also released

new System 38 and Series/1 models. In addition to new minicomputer products, IBM has begun to court OEM vendors--traditionally a market segment reserved for minicomputer vendors such as DEC and DG. IBM is offering discounts and, in the case of the popular System 36, reserving large quantities of machines from OEM vendors.

- In a sense, the minicomputer market is a natural for IBM for several reasons:
 - This market is growing rapidly--particularly in the areas of office automation and CAD/CAM. The market's expected 20% (or more) growth rate is the kind IBM needs if it is to continue its historical growth rates.
 - The minicomputer market is in rapid technological change. Vendors are moving away from 16-bit toward 32-bit machines and there is an increasing dependence on high technology peripherals. This situation is well suited to IBM where research can be leveraged over several product lines.
 - There is a growing emphasis on improved software. Users are expecting the vendors to take on more responsibility as system integrations and communications specialists. IBM is well suited to this market requirement as a result of their expensive product line and excellent reputation for comprehensive software support.
 - Users are becoming more dependent on their microcomputers and therefore require improved service and support. Originally, the minicomputer market consisted primarily of technical users whose service needs were restricted at best, but as new user markets opened up to minicomputers, there came an increasing demand for support. IBM has in the past and will continue to stress its excellent service reputation.

- In order to access the traditional (16-bit) minicomputer market, IBM depends primarily on the Series/1 and the System 36. The system 34 is an outdated yet still popular machine.
- The Series/1 was originally introduced in 1976 and, as such, is one of the older designs in the market today. However, IBM has periodically upgraded this 16-bit machine and it remains a popular product particularly in business and commercial applications. The /1 can be configured with up to 1 M-byte of main memory which can handle over 100 workstations.
- Because it has been on the market for a long time, the Series/1 has the advantage of offering a wide variety of application packages. In addition, the system provides very flexible hardware configurations (due to the Series/1's modular design).
- The System 36 has been described as "the perfect upgrade" to the System 34 and clearly this was IBM's intention when the 36 was introduced. The 36 can be figured with up to 512 K of main memory and 800 M-bytes of disk storage. Up to 30 local workstations and 64 remote workstations can be supported by the 36.
- As noted above, the 36 was designed to upgrade the aging System 34. The 36 can be configured with up to 30% more processing power than the 34 along with larger disk storage and more workstations. Despite these improvements, the System 36 is almost completely data and peripheral compatible with the System 34.
- In April 1984, IBM enhanced the System 36 with a new low-end model 5362. While it cannot support as many workstations as the original 36 (model 5360), the 5362 is less expensive and more accurately aimed at the office automation environment.

- The System 34 was originally introduced in 1977 and has proven to be the workhorse of the IBM minicomputer line. When the System 36 was introduced in 1983, the 34 became an outdated product, but is still offered by IBM. The 34 can be configured with between 32 and 256 K of main memory and up to 257 M-bytes of disk storage. All System 34 models can support 16 local users and 64 remote users.
- Because of the increased performance and lower price of the System 36, it is unlikely that the System 34 will remain a viable product for long. It should be noted, however, that the chief advantages of the 34--upgradability from the System 32, and a substantial migration within the product line--helped to make this product one of the most popular minicomputer systems within its price range.

H. NCR

- In many ways NCR has an advantage over its traditional "bunch" rivals in the minicomputer market. NCR was one of the first traditional mainframe vendors to recognize the futility of going head to head with IBM in all market segments. The Dayton-based company restructured its product line to emphasize its superminicomputer specialization (e.g., the 32-bit 9300, 85XX, and 86XX) rather than the traditional 64-bit mainframe. At the lower end, NCR has introduced personal computers, word processors, and even a 16-bit mini (the Tower 1632).
- These products are much more market oriented than some competitive products. NCR has identified certain key market segments that they want to specialize in, such as banking, and the company is not averse to aiming a particular hardware product at just one market. An indication of the company's market orientation is NCR's decision to use the same Systems Network Architecture (SNA) communications protocol as IBM. In the past this

would have been unthinkable, but in today's competitive environment, NCR realizes it is better off with part of an order than possibly no order at all.

- The Tower series is NCR's low entry into the minicomputer market. This is a 16-bit product that can support up to 16 workstations. Memory capacity ranges from 512 K up to 2 M-bytes with a maximum disk storage of up to 260 M-bytes.
- The Tower is available in three models: the Tower 1632, the 1632XP, and the I Tower. Currently, there is no upgradability between the Tower 1632 XP and the I Tower--a major disadvantage when compared to competitive products such as the Wang VS line or DEC Micro PDP series. In keeping with the company's strategy of being market driven, NCR can offer a tremendous variety of application software (both in-house and third party) to Tower users. This represents a significant advantage for NCR at this low end of the market.
- The I 9020 is NCR's midrange minicomputer. The 9020 is a 16-bit machine capable of supporting up to 24 users. (At this time there is no migration path between the 16-bit Tower and the 9020.)
- The I 9050 is the top-end of the traditional minicomputer line. Actually the 9050 is a 32-bit machine and would normally be considered part of the super-minicomputer market but is included here because the 9020 can be upgraded to a 9050. The I 9050 is however a substantial upgrade over the 9020. The maximum main memory for the 9050 is 4 M-bytes that can support up to 256 workstations with disk storage of up to 14 gigabytes.

I. PERKIN ELMER CORPORATION

- Perkin Elmer's Data Systems Group sells and services the company's 32-bit line of superminicomputers in addition to a variety of other products such as 16-bit personal computers. While the Data System Group's performance has improved (Marginally) since 1982, computer revenue has remained essentially stagnant (at just over \$200 million) since 1980. The Data Systems Group currently earns approximately 20% of the company's total revenue.
- Although Perkin Elmer pioneered the 32-bit superminicomputer market, the company has been hurt in the 1980s as a result of increasing competition. The major competition in this market reads like a Who's Who of the computer industry; IBM, DEC, DG, Prime, AT&T, NCR and Wang—to name just a few. The explosion in new products for this market has effectively negated any competitive advantage held by PE at the end of the 1970s.
- A niche strategy--specializing in scientific and technical markets--seems to be Perkin Elmer's solution to increasing competition in the 32-bit supermini market. PE is well known in this market as a result of the company's Instrument Group which actively markets in this area. Despite the fact that the company is well known, the scientific and technical market are not rapidly expanding which explains the company's growth patterns since the early 1980s.
- In order to open up potential new markets, Perkin Elmer announced its "Energyware" strategy. This strategy essentially accepts industry standards for connect protocols. These standards include SNA, IEEE Ethernet LAN, UNIX operating systems, etc. At the heart of the Energyware is Perkin Elmer's own Pennet Local Area Network designed to link PE equipment via private lines or packet switching networks.
- Like many other vendors, Perkin Elmer has recently introduced a personal computer in order to complete its product line. However, unlike many

vendors, PE has gone to great lengths to ensure data compatibility between its 16-bit model 7350 Professional Computer and its 32-bit superminis. The 7350 can be configured with up to 1 M-byte of main memory and a 15 M-bytes Winchester disk drive. In its fully defined configuration, the 7350 can handle up to three additional terminals.

- While the 7350 was certainly necessary as an entry level system, Perkin Elmer's bread and butter comes from the 3200 series of superminicomputers. The company currently has five systems ranging from the \$25,000 Model 3205 up to the \$200,000 Model 3200 mps.
- The 3205 is the entry level model for the 3200 series (excluding the 7350 PC). The 3205 has a maximum capacity of 4 M-bytes of main memory, 1.2 gigabytes of disk storage, and can support up to 16 workstations. One of the major advantages of the 3205 specifically and the 3200 series in general, is the data and hardware compatibility. Users have a clear and relatively well established migration path from the 3205 all the way to the top-end 3200 mps.
- The 3210 was introduced in 1981 and is aimed at the low-end/mid-range market. The system has a performance rating of 1 mips with a maximum memory capacity of 4 M-bytes. The 3210 can support up to 32 users.
- The 3230, 3250 XP, and 3200 mps represent progressively more powerful processors in the 3200 series. The 3200 mps can support 128 users—somewhat less than competitive vendors offer—but performance ratings of five mips for the mps along with 16 M-bytes of main memory and 500 gigabytes of disk storage make this system one of the most powerful in the superminicomputer class.
- The fact that the 3200 mps is such a powerful machine and yet is (data) compatible with the entry level personal computer, is a strong selling point for the 3200 system line.

- In addition to expandability, PE has demonstrated a substantial commitment to communication capability with a broad range of standard systems via its "Energyware" software. This will prove to be a major advantage for users coordinating a multisystem network environment.

J. PRIME COMPUTER

- Prime is a much more focused company than many of its competitors such as DEC and Data General. In its heyday, the late 1970s, Prime concentrated exclusively on the 32-bit superminicomputer market and was remarkably successful. Between 1973 and 1978, for example, net sales increased an average of 103% per year.
- Growing competition and some internal strife has taken the edge off Prime since the early 80s. Although sales continue to grow at respectable rates (20%), net earnings fell in 1983 by almost 28% (to \$32.5 million).
- The slowdown in sales at Prime should have been expected. In the late 1970s, the company was on the crest of a wave with a leading-edge product and a marketing strategy to match. While other vendors—particularly Data General—were selling their products to OEM and value-added dealers, Prime was selling directly to end users. The demand was huge because of the main-frame-like performance of the new superminis. But success breeds competition and as industry heavyweights such as DEC, and IBM began to enter the market, users began to require even more from their supermini vendor.
- As the market for superminicomputers began to mature, users started to expect more than just a technically efficient machine. An expanded product line—particularly at the low end for office automation—was required, as was improved communication and networking capabilities. Vendors, such as Prime, that did not have the resources to expand their product line or increase software support are now feeling the pressure from the market.

- To its credit, Prime has recognized the trends in the market and has begun to make a change in the fundamental philosophies of the company. With its new IBM-style President (Joe Henson), Prime is trying to "shift gears" and enter new high-growth markets such as office automation. The evidence is there to see--support services have improved dramatically, new, low-end microcomputers/workstations have been introduced, and the company has expanded its niche-oriented product line at the upper end.
- Prime has a secure foothold in the CAD/CAM market with a broad line of products, such as electrical design (EDMS) and Plant design (PDMS). Of course, with its strong background in scientific and technical applications, it is expected that Prime will perform well in this market. Currently, the company earns about 20% of its total revenues from its CAD/CAM market.
- The second major market niche Prime has identified is the office automation market. Unlike the CAD/CAM market, Prime does not have a natural user base in the office automation market and its performance in this area has not been overwhelming. The broadened product line and improved support services should have a very positive impact for Prime in the OA market.
- As mentioned earlier, prime has expanded its "50" series of superminicomputers significantly in order to access new markets. Currently, this series includes the 2250, 250, 450, 550, 750, 850, and 9950.
 - The 2250 was introduced in 1982 and is designed as an entry level system aimed primarily at the business market. The 2250 can support up to 32 workstations with a maximum capacity of 4 M-bytes. Like all the "50" series, the 2250 can take advantage of software and hardware compatibility throughout the series.
 - The 250, 450, and 550 are relatively old machines (1981 and early 1982 introduction data) that are designed for mid-range processor require-

ments. Memory capacity on the three machines ranges from 512 K- to 4 M-bytes with a maximum disk storage of up to 5 gigabytes. The 250 can support up to 32 users, while the 450 and 550 can support 640 users each.

- The 750 and 850 represent a significant step up from the mid-range 450 and 550, but it is likely that the 750 and 850 will be phased out of Prime's series of superminis now that the 9950 is available. The former top-of-the-line 850, for example, has a maximum memory of 8 M-bytes compared to 16 M-bytes for the 9950 at a similar price.
- The 9950 is Prime's new top-of-the-line system possessing up to 50% more processing power than the 850. The 9950 can support only 128 workstations—a problem in office automation applications, but does use an ECL (emitter coupled logic) circuitry and pipeline architecture to ensure very high speed performance. The 9950 also has a diagnostic processor which allows advanced remote support capabilities.

K. TANDEM COMPUTERS

- Tandem Computers has identified and entered into one of the fastest growing small-system markets—fault-tolerant computers. The company, which began in 1976, was the first major computer vendor to enter this submarket and remains today a market leader. Overall revenues in 1983 were \$418 million with a net income of \$30.8 million. Between 1979 and 1983, Tandem grew at an average annual rate of 50%.
- Although Tandem's growth is slowing somewhat now, the company continues to benefit from two important factors: 1) the demand for fault-tolerant systems continues to grow dramatically, and 2) competition in the fault-tolerant submarket—particularly from traditional minicomputer vendors—has not been substantial.

- Tandem is in an excellent position because the market for fault-tolerant systems seems to be unaffected by the intense competition in both the 32-bit superminicomputer market and the high-end superminicomputer market. Tandem's competition generally comes from start-up companies rather than established vendors who must consider their installed base. Tandem's nearest immediate competitor is Stratus--a considerably smaller company than Tandem. (1983 revenues at Stratus were \$21 million, barely 5% of Tandem revenues.)
- Tandem has also taken advantage of the fact that demand for fault-tolerant systems is expanding rapidly. Originally confined to strictly critical applications, the uses of fault-tolerant systems now include manufacturing, banking, transportation and other industries where there is a high level of sensitivity toward system failure. This user sensitivity is driven by several concerns:
 - The increasing importance of on-line rather than batch processing systems.
 - User requirements for a very high level of system availability.
 - Departmental interdependence (particularly in areas such as Process Control).
- The NonStop II and NonStop TXP are Tandem's two major fault-tolerant systems. The NonStop was originally introduced in 1976 and upgraded to the NonStop II in 1981. Although the NonStop II has 32-bit addressing, it is a 16-bit machine. One of the major advantages of the NonStop line is its networking capabilities. Up to 16 processors can be attached to one system and up to 14 systems can be interconnected using fiber optic technologies and up to 255 systems (over 4000 processors) can be interconnected using Tandem's EXPAND network.

- The Tandem NonStop TXP is the company's latest addition to the NonStop family having been announced in October 1983. The TXP is a true 32-bit machine and provides up to three times the performance of the NonStop II. The TXP can be configured into a network of up to 4000 processors (the same as the NonStop II) with 16 M-bytes of main memory each.

L. WANG LABORATORIES

- Although Wang produces a series of minicomputers (the VS line, discussed below), the company does not look upon their market as the minicomputer market but rather the office automation market. This has been a very successful approach for Wang; total revenue has increased from \$856 million in 1981 to just over an estimated \$2 billion in 1984.
- Almost half of Wang's current revenues are derived from the sale of small systems, including superminicomputers. These include the 32-bit and 16-bit VS series which range in price from \$20,000 to over \$500,000 (system price). In addition, the company produces a PC (called the Professional Computer) and PIC (Professional Image Computer).
- Wang always seems to be in the right place at the right time. The company's experience with small business computers led to growth in word processing which, in turn, led into the development of a supermini in the late 1970s which provided the power for a real push into the office automation market in the 1980s. The company planners seem to have an uncanny ability to understand the needs of the market and to let the market demand drive product development.
- By its own design, Wang is strategically located at the heart of the office automation market. With the addition of the VS-15 at the low end and VS-300 at the high end, Wang has one of the most complete product lines in the

industry. In addition, Wang offers a number of products and services now (e.g., WangNet and integrated applications software) that other companies can only promise to have in the future.

- The company has been well served by a policy of continuing development of the office automation market, but it is now finding itself in stiff, head to head competition with other vendors, such as IBM, that also want a share (or all?) of the OA market. INPUT expect Wang to continue development of both the PC and supermini in order to maintain high growth rates. However, growth against the likes of IBM, DEC, and HP will be considerably different than Wang's past experience with vendors such as NBI, Lanier, and CPT.
- As noted above, Wang has a very strong product line with the 1984 introduction of new high-end low-end machines:
 - The VS 15 was introduced in June of 1984 and is a 16-bit system designed for small offices (i.e., less than 10 workstations). The VS 15 is priced in the \$18,000 to \$20,000 range and can be configured with up to 75 M-bytes of disk storage. The 15 is considerably less expensive than the previous entry level model, the VS 25 and yet has similar performance characteristics.
 - The VS 45 was originally introduced in 1982 and is upgradable from either the VS 15 or VS 25. The 45 has a maximum disk storage of 2.5 gigabytes and can support up to 20 workstations.
 - The VS 80 is the top end of the Wang's 16-bit product line, however, the hardware is not upgradable from the VS 15, 25, or 45. The VS 80 can support up to 32 users and 5.1 gigabytes disk storage.
- Wang currently has four 32-bit minicomputers in the VS series. These include the VS 85, 90, 100 and VS 300.

- The VS 85 and VS 90 have similar characteristics (e.g., 1-4 M-bytes of main memory, VS-OS operating system) except that the 90 has a larger disk storage capacity (5.1 gigabytes as opposed to 2.4 gigabytes for the 85) and the 90 can support 48 workstations rather than the 32 workstations supported by the 85. Both the VS 85 and 90 are upgradable to the VS 100.
- The VS 100 is an old machine, introduced in 1979, but it is a good addition to the VS line. The 100 can support up to 128 workstations and can be configured with up to 8 M-bytes main memory. Until the introductions of the VS 300, the age and limited capacity of the 100 was considered a serious shortcoming of the VS line.
- The VS 300 is Wang's top of the line 32-bit supermini. The 300 can support up to 192 users with a maximum disk storage of 20.4 gigabytes. The system's main memory capacity will be between 4 and 17 M-bytes and performance is rated at 3.3 mips.
- A major advantage of the Wang VS series of minis--particularly from a support standpoint--is the use of standard operating systems and peripherals. This makes the migration from even the smallest VS 15 to the largest VS 300 not only a possibility, but a reality.
- A second major advantage is the progress Wang has already made in the office automation environment. As noted above, Wang currently has office networks and products which other companies can only promise. In addition, there is every reason to expect that the company's goal of expanding the technology used in office automation will be successful--especially in the areas of image and audio processing.

V SMALL-SYSTEM SERVICE DEVELOPMENT TRENDS

V SMALL-SYSTEM SERVICE DEVELOPMENT TRENDS

A. THE CHANGING STRUCTURE OF SMALL-SYSTEM SUPPORT, 1984-1989

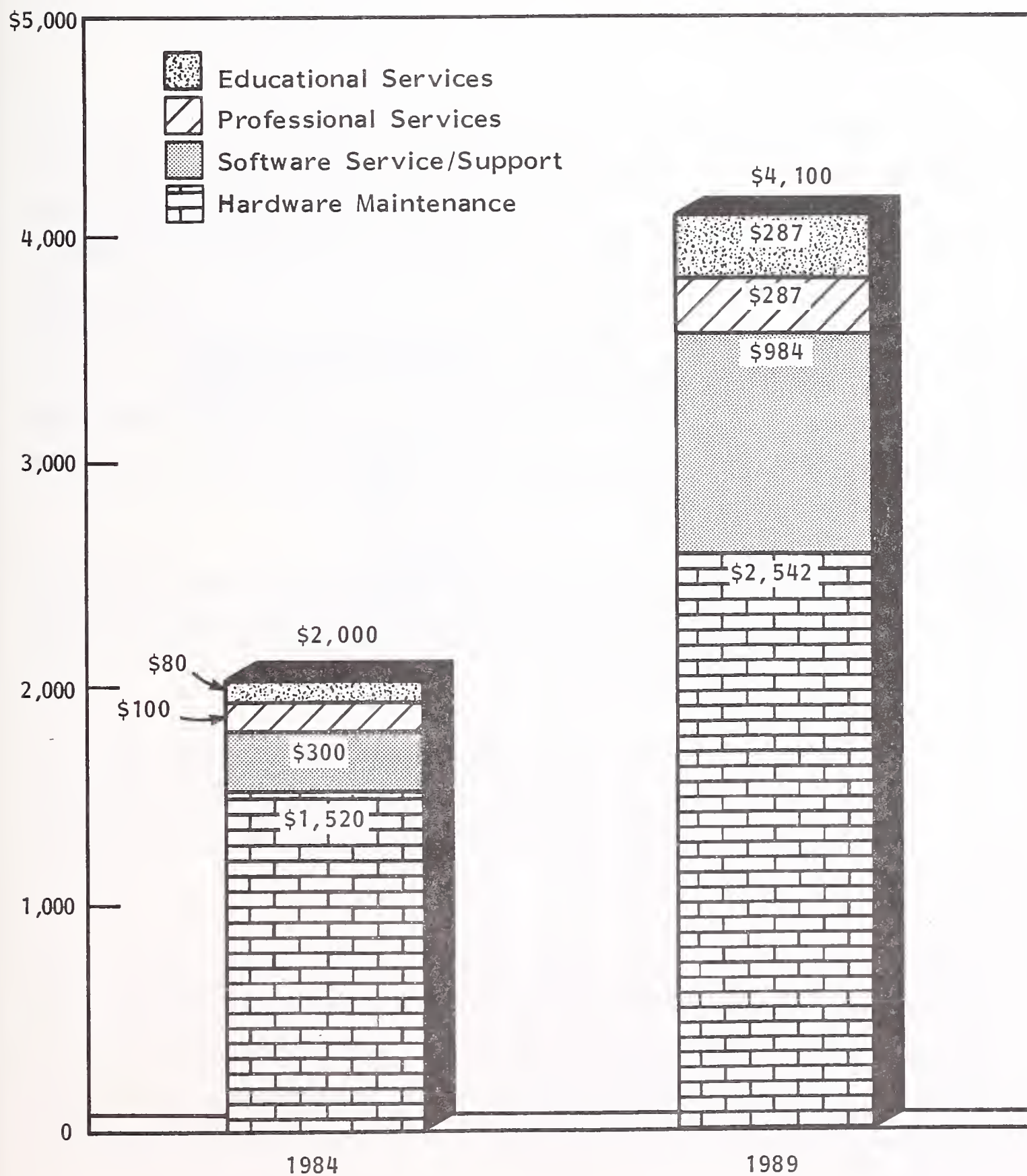
- Service and support of 16-bit minicomputers, small business systems, and now superminicomputers has traditionally been quite different than support of the larger and more expensive mainframes. Large-system users typically required very extensive service such as on-site engineers and parts, rigid escalation and dispatching procedures, and, in general, a great deal of "hand holding" by the service vendor.
- Initially specializing in scientific and technical markets, small-system vendors had a certain amount of chauvinistic pride in the fact that their users did not require "hand holding" as did the large-system users. Because the small-system vendors did not need to offer extensive services they could charge lower prices for service. When combined with the substantially lower cost of hardware, price becomes a major competitive advantage of small-system vendors.
- In the late 1970s, three factors occurred, almost simultaneously, that proved to have a tremendous impact on small-system service:
 - Microcomputers were introduced and began to take market share away from the low end of the minicomputer market.

- The popularity of 32-bit superminicomputers began to take away market share at the upper end of the traditional 16-bit market.
- IBM introduced its successful 4300 series that set a new price/performance standard for mainframes--no longer did minicomputers, as a group, have lower operating costs than mainframes.
- In addition to the extraneous factors impacting the small-system market, minicomputer vendors found that they needed new high-growth markets (other than scientific and technical) to continue high growth rates. The markets that the minicomputer vendors (either themselves or via OEM vendors) went into such as education, manufacturing, and office automation, required high levels of service and support--levels which some of the vendors were not prepared to offer.
- All of these factors have combined in the mid-1980s to produce a small-system service environment which is dramatically different--both in quality and quantity--than anything existing previously. As Exhibit V-1 demonstrates, small-system service is continuing its evolution. In the future there will be a substantially reduced dependence upon hardware maintenance revenue and a sharp increase in dependence on software maintenance. Both educational and professional services will become more important in direct relation to the small-system vendors' success in entering the systems integration and site-management markets.
- Hardware maintenance revenues will be increasing at a much slower rate (11% average annual growth rate) than other maintenance components such as software support (27% AAGR), professional services (23% AAGR), and educational services (29% AAGR). As a result, hardware maintenance revenues will become proportionally less important by 1989--when they will represent 62% of all small-system service revenues--than they are today (representing 76% of all service revenues).

EXHIBIT V-1

SMALL-SYSTEM CUSTOMER SERVICES REVENUE SOURCE MIX

1984-1989



- The relative decline in importance of small-system hardware maintenance is the result of several major factors which will be discussed in detail below. It is important to note, however, that hardware maintenance still represents the most substantial incremental revenue increase (over \$1 billion) in the small-system service market. Exhibit V-2 demonstrates that even though educational and professional services are growing at over twice the rate of hardware maintenance, their incremental revenue is less than one-fifth that of hardware maintenance.
- Software maintenance and support--as shown in Exhibit V-3--is growing at 27% per year and by 1989 will represent 24% of the total customer service revenues for large system vendors. Growth in software support--also discussed below--will result from three major factors:
 - In order to maintain high service growth rates despite declines in hardware maintenance growth, vendors will be looking for new revenue sources. Since users have consistently--and vocally--demanded improved software support, it seems likely that this will be a potential source of new revenue.
 - Some large-system vendors--who frequently identify trends before they impact the small-system market--have begun to announce sharp increases in software support.
 - Small-system users are particularly dependent on software support. As equipment becomes more complex (e.g., 32-bit superminis) and inter-related (office automation), the opportunity will arise to offer new software support services.
- Exhibit V-4 demonstrates that while users are clearly dissatisfied with software support, documentation, training, and even consulting are problem areas as well. User dissatisfaction with professional and educational services will fuel much of the 20+% growth in these areas. Educational services will be the fastest growing service sector (29% AAGR) as a result of three main factors:

EXHIBIT V-2

SMALL-SYSTEM SERVICE GROWTH BY SECTOR, 1984-1989

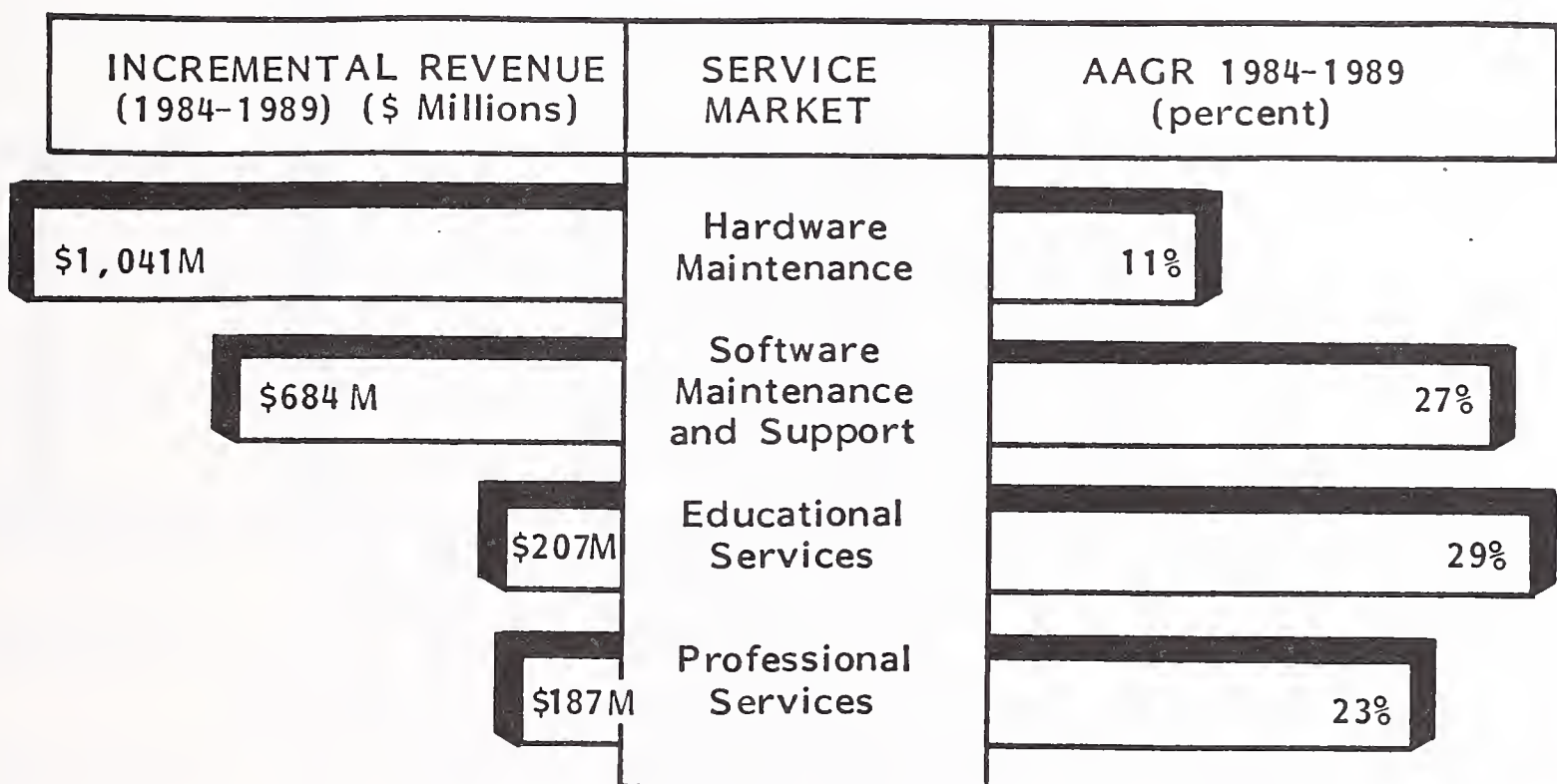
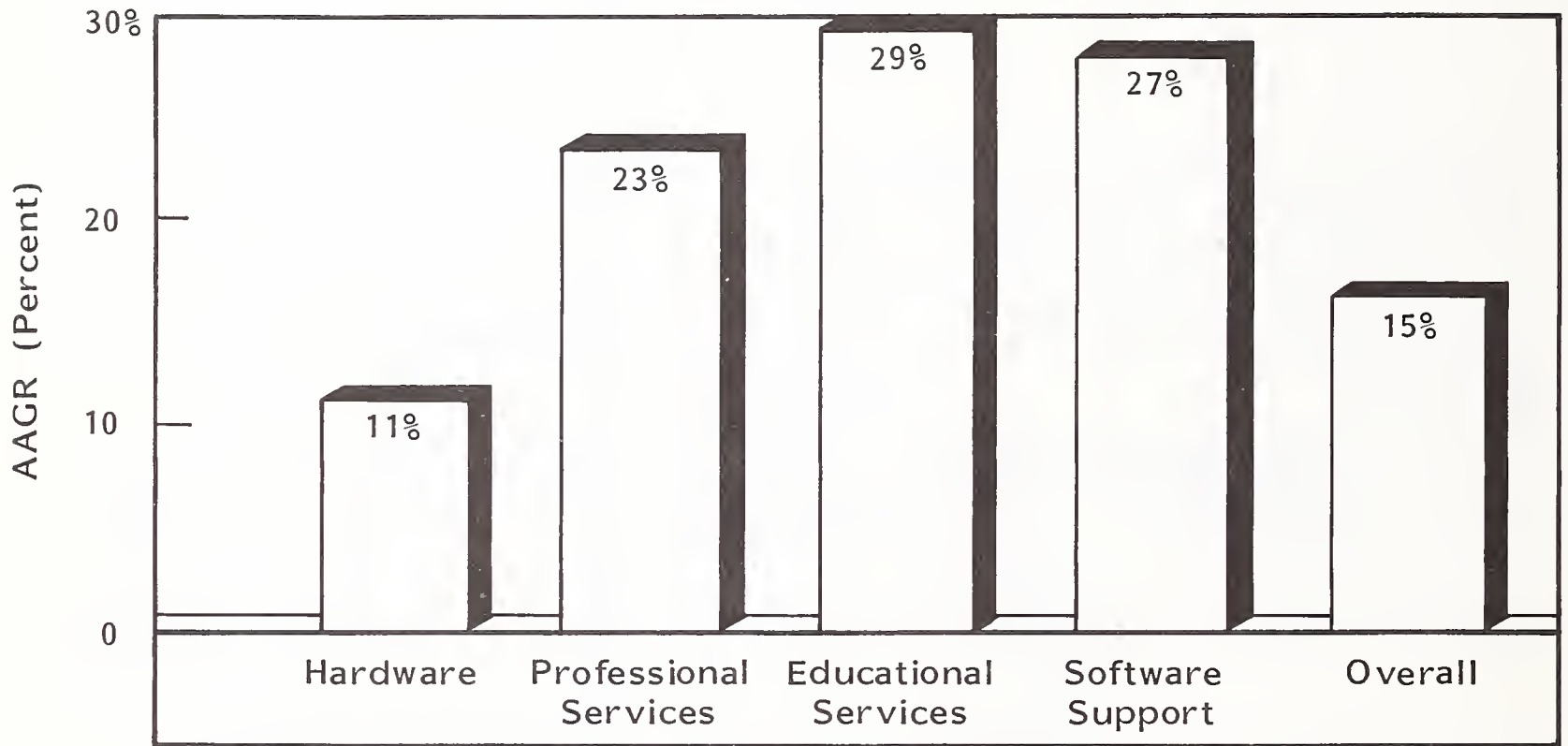


EXHIBIT V-3

SMALL-SYSTEM SERVICE GROWTH, 1984-1989

Average Annual Growth Rate (AAGR)
for Small-System Service Sectors, 1984-1989



Small-System Service Revenue Mix by Sector, 1984-1989

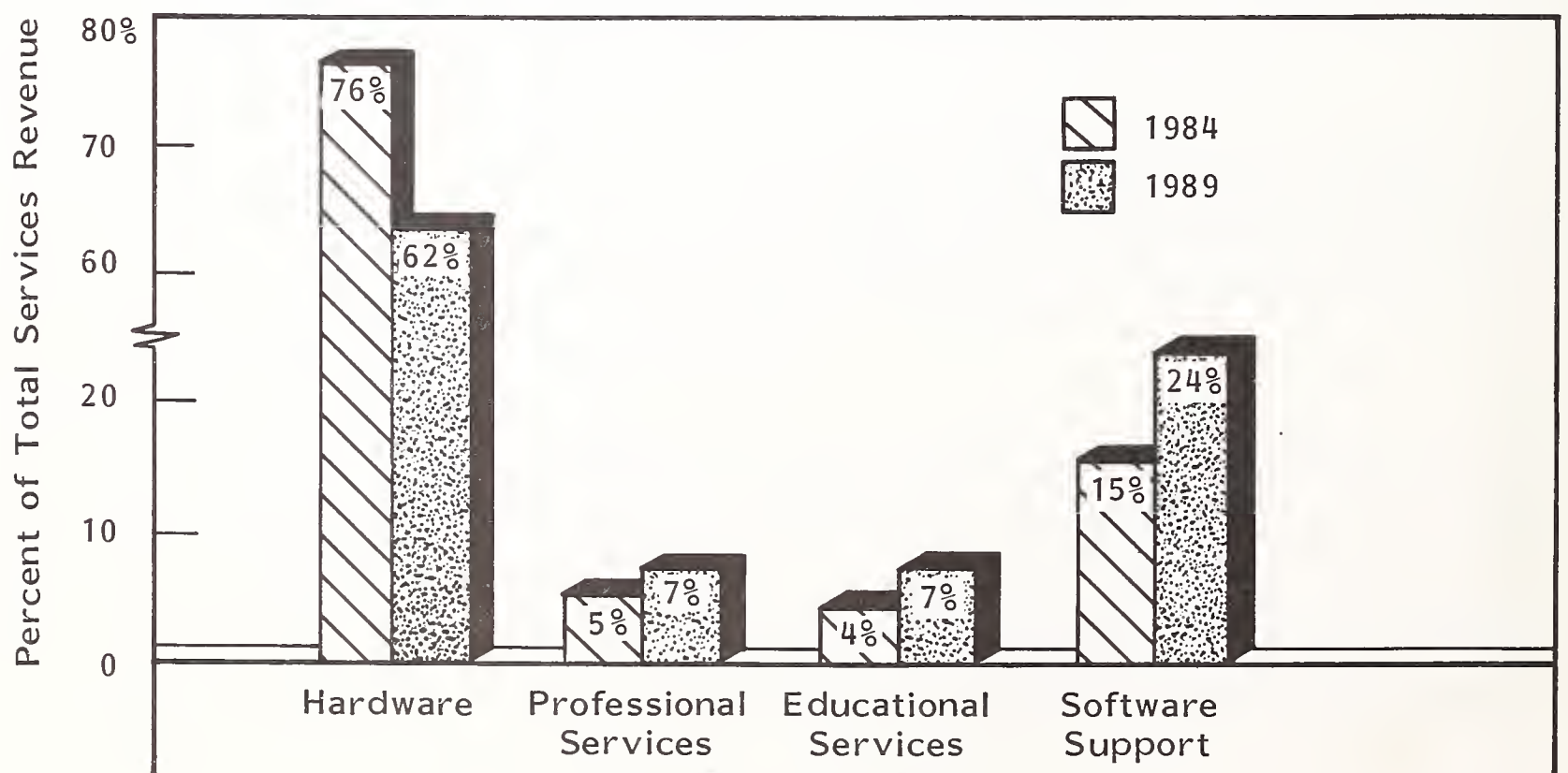
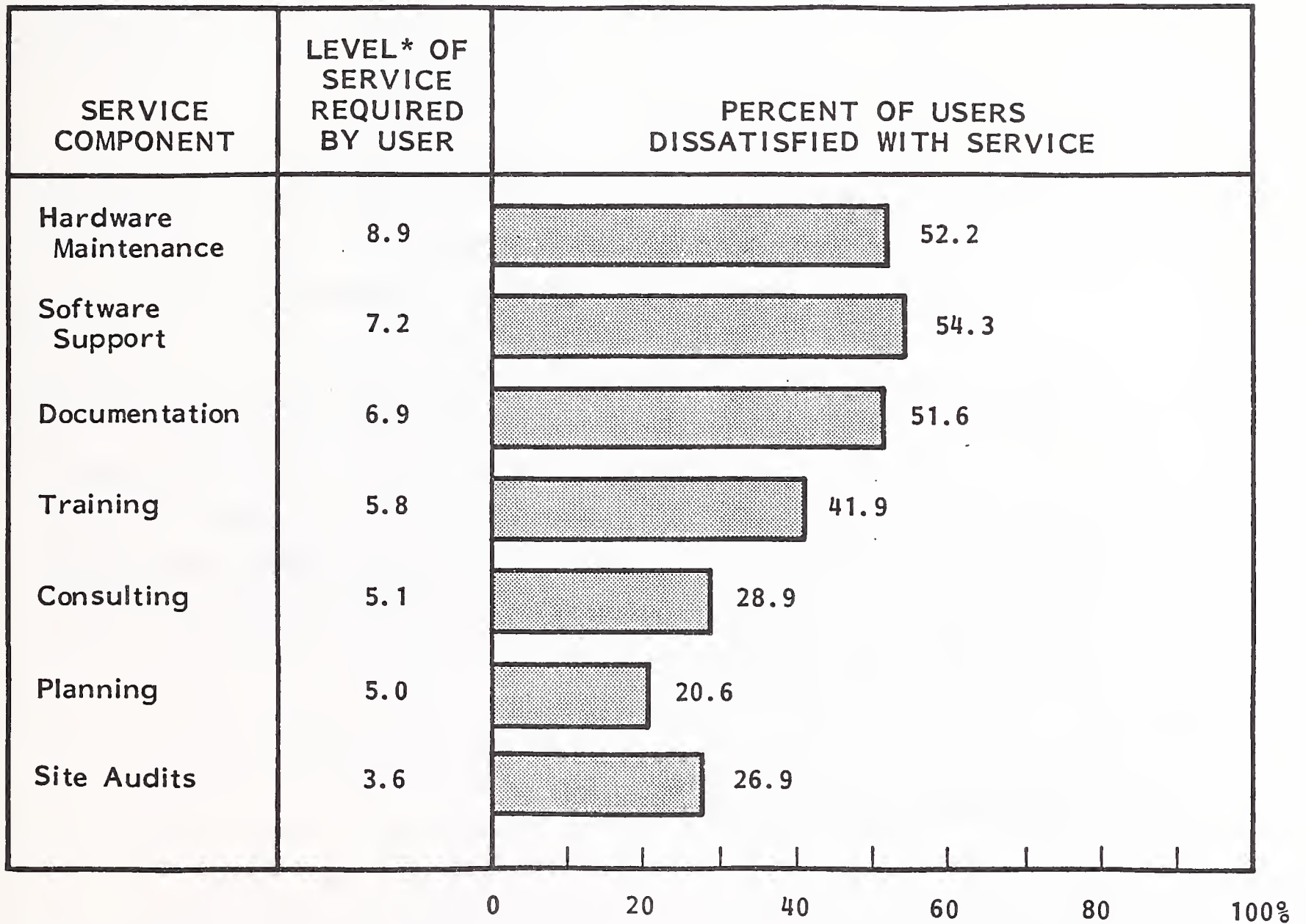


EXHIBIT V-4

SMALL-SYSTEM USER POSTSALE SERVICE REQUIREMENTS



* Rating: 1 = Low, 10 = High

- As vendors continue their penetration of the commercial market, there will be increasing demand by users for training departmental workers in hardware as well as systems and applications software utilization.
 - Because training materials are easily maintained and do not require frequent updates, educational services provide high profit margins once the initial program development is established.
 - Educational programs are not necessarily tied to just one product. These programs can be spun off as totally separate products, or can be used to support several of the vendors' hardware product lines.
- Professional services, as noted above, will grow primarily as the result of increased user demands for system integration and site-managment. Most users in Exhibit V-4 appear to be relatively satisfied with services such as consulting and planning, but at the same time, they do not have a high requirement for these services. INPUT expects small-system users, in particular, to become much more demanding in terms of professional services as their requirements increase.

B. HARDWARE SERVICE TRENDS

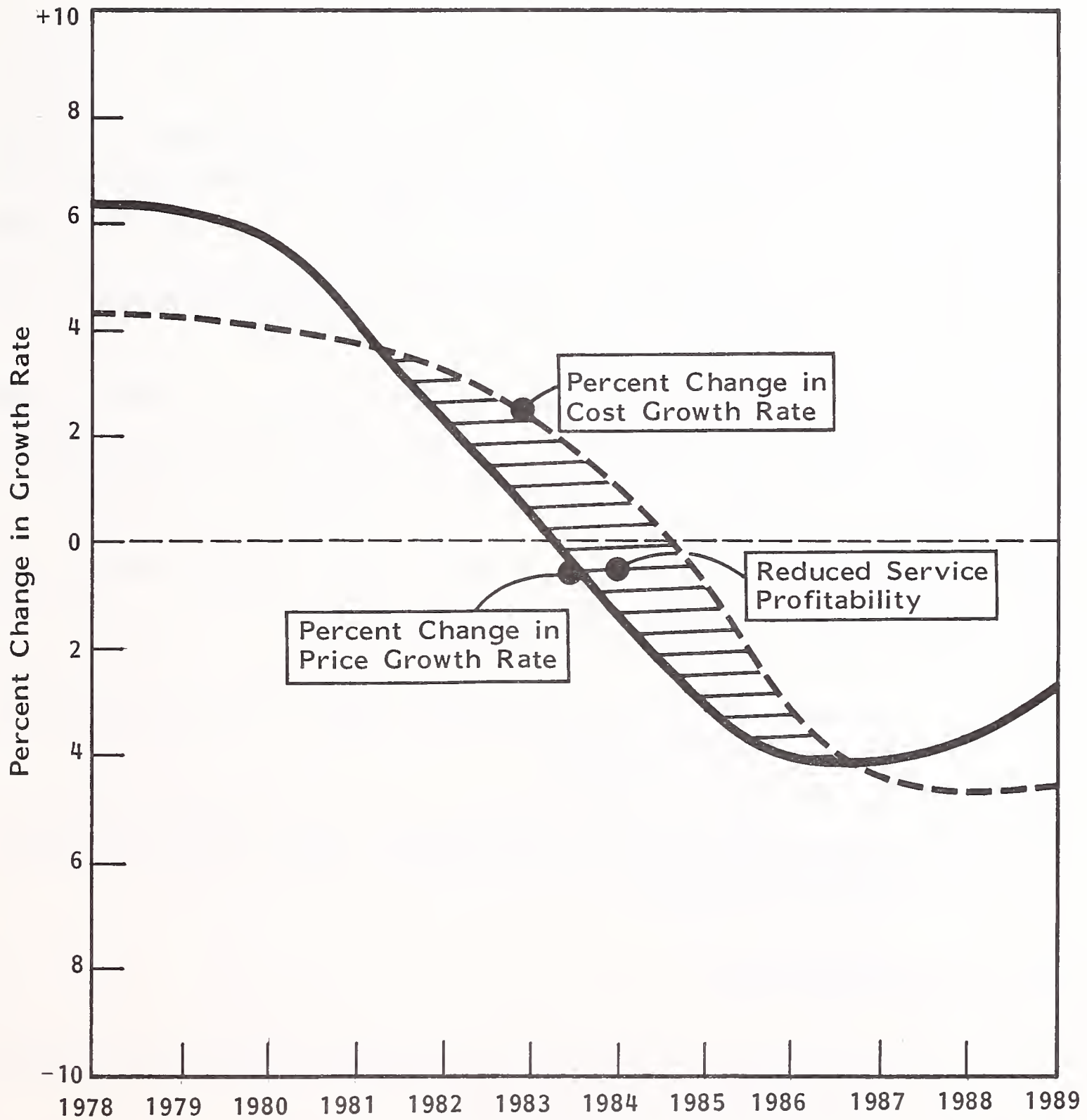
- Hardware maintenance is and will continue to be for quite some time the number one service requirement for small-system users. As noted above, hardware support currently represents over three-quarters of all small-system service revenue and, even with substantial gains made by software support and other services, hardware maintenance will equal well over 60% of small-system service revenue by 1989.

- While user attitudes and satisfaction levels with service are affected by a number of different factors, there is a high correlation between user satisfaction with hardware maintenance and satisfaction with overall service. And yet, despite the obvious emphasis users place on hardware maintenance, they are entering substantial pressure on vendors to lower prices. This pressure is comprised of several very different components.
 - Users feel that as the price of equipment falls, so too should the price of maintenance. This feeling is supported by the fact that service prices are tied directly to equipment prices at time of purchase.
 - As the equipment becomes more reliable, users also expect a reduction in service prices. Typically, users see little or no reason for prices to even remain stable, not to mention increase, when their machines are not breaking down.
- In addition to user expectations for lower service prices, vendors have been encouraged to lower prices as a result of technological advances which have reduced the marginal cost of service. These advances--which were introduced in the late 1970s and early 1980s--were designed primarily to lower the cost of service and increase profitability, not to decrease the price of service. However, under pressure from users and to remain competitive, vendors are utilizing this cost savings to reduce prices rather than increase profitability.
- The trend toward falling hardware service prices is not unique to the small-system market, prices are falling dramatically in both the mainframe and personal computer market as well, INPUT estimates that hardware maintenance prices for mainframes will fall by over 10% a year through 1987. The decline in personal computer hardware maintenance prices will be even sharper--from an average of \$550/year for on-site support in 1982 down to approximately \$200/year in 1989, an average annual decline of almost 20%.

- Although the decline in the growth rate of hardware service prices is consistent between the product sectors, there are different causes, and reactions for each product type. The reduction in personal computer on-site service, for example, is primarily the result of the sharp decreases in PC equipment prices. Maintenance as a percent of PC purchase price actually only falls from 17% in 1982 to 15% in 1989. Mainframe hardware service prices are falling in reaction to new competitive pressures from industry leader IBM, increased equipment reliability, and improved service technology.
- Small-system hardware service prices are not expected to decline as sharply as either mainframe or PC prices. Exhibit V-5 demonstrates that the overall hardware pricing trend changed from growth to decline in the 1980s. From 1978 through 1983 prices were still increasing, but at a slower and slower rate. Currently, overall hardware prices are declining and will continue to decline--though at varying rates--through the end of the decade.
- It is understandable, considering the unbroken record of service price increases, that some small-system vendors have been slow to react to this fundamental change in service pricing. Many vendors (particularly the small service vendors) have failed to reduce service costs in concert with service price reductions believing that the price reductions are only a temporary aberration. The trend in hardware service prices is, however, not a temporary aberration; prices will continue to fall and vendors that do not compensate with lower hardware service costs will be faced with reduced service profitability.
- There are two primary components of the reduction in small-system hardware service prices:
 - A higher level of user sophistication in analyzing service costs resulting in increased pressure for lower service prices and increased vendor competition in service pricing.
 - Technological advances that permit vendors to lower costs.

EXHIBIT V-5

SMALL-SYSTEMS HARDWARE SERVICE PRICE
VERSUS COST GROWTH, 1978-1989



- Of the two, technological advances represent the lion's share of hardware service price reductions, but vendors should not discount the importance of remaining service price competitive with regard to their older installed base. Exhibit V-6 demonstrates that while the average service price has declined only slightly (1.3% of purchase price) between 1982 and 1984, the actual savings to the customer is quite substantial considering the cost of inflation and the decline in purchase price of small-system equipment.
- In general, small-system users are becoming much more adept at analyzing the long-term cost of equipment (of which service is one of the most important components). Exhibit V-7 demonstrates the type of analysis used by many small-system customers in making equipment selection decisions and the importance of the cost of service in that decision. The exhibit shows that although the initial purchase prices of the equipment may be equal, long-term costs make vendor C much more competitive than vendors A and B.
- As competition for small-system service begins to heat up, it will be more and more necessary to use price as a competitive tool. Vendors must be prepared to react more quickly to user requirements in the area of service pricing.
- By remaining service price competitive on older machines, vendors must consider several factors--on the positive side:
 - Competitive service prices will help to fight off TPM penetration into the vendor's service market.
 - Lower service prices will contribute to a higher level of user satisfaction with the vendor.
- On the negative side:
 - By maintaining artificially low service prices, vendors may not achieve desired levels of service profitability.

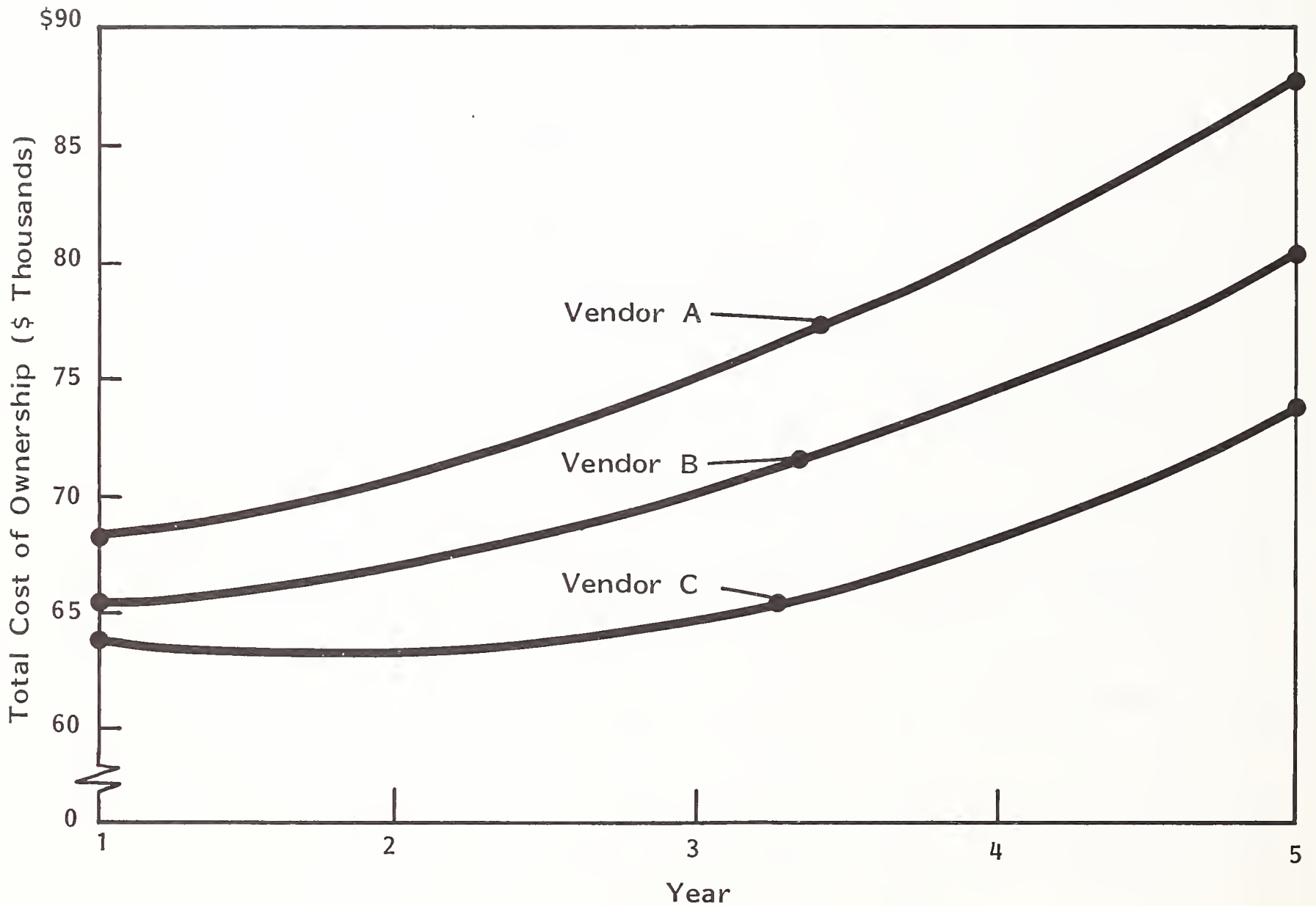
EXHIBIT V-6

SMALL-SYSTEM AVERAGE CONFIGURATION SERVICE PRICE TRENDS

VENDOR	PRODUCT	SERVICE AS PERCENT OF PURCHASE PRICE		
		1982	1984	△
CDC	480-II OME GA	8.2	7.0	(1.2)
Hewlett-Packard	3000/30	10.6	7.0	(3.6)
IBM	System 38/3-21	7.3	7.9	0.6
NCR	8150	12.6	9.7	(2.9)
Perkin Elmer	8/32	9.0	10.5	1.5
Prime	150/II	6.0	6.0	-
Wang	VS-100	12.8	9.1	(3.7)
Average		9.5	8.2	(1.3)

EXHIBIT V-7

TOTAL COST* OF SMALL-SYSTEM OWNERSHIP



Vendor	Purchase Price (\$ Thousands)	Annual Maintenance as a Percent of Purchase Price (Percent)	Cost of Maintenance Over 5 Year Life of the Machine (\$ Thousand)	Total Cost (\$ Thousands)
A	\$63,400	7.8%	\$24,600	\$88,000
B	62,100	6.2	19,275	81,375
C	62,100	4.0	12,540	74,640

- Low service prices on the older installed base will act as a deterrent to new equipment sales, particularly as vendors increase the use of service pricing as a sales feature.
- Ultimately, user and competitive pressure will force vendors to reduce hardware maintenance prices on some machines, however, INPUT does not expect any radical reductions. With the dramatic increase in new small-system product announcements, it is likely that vendors will attempt to placate their users until their next new system is unveiled at which time the vendor will use service pricing as a tool to encourage user migration from the older to the newer machine.
- As noted above, most decreases in hardware service prices will result from technological advances in services that, in turn, make equipment more reliable and reduce service-related costs. Service-related technology that will impact costs the most in the next five years includes:
 - Remote support.
 - Development of fault-tolerant sales systems.
 - Increased modularization of systems.

I. REMOTE SUPPORT

- Seventy-seven percent of the small-system vendors interviewed by INPUT currently offer some form of remote support services (RSS) and although the level of support is not as sophisticated as in the large-system environment, small-system vendors have expressed a definite commitment to the development of RSS.

- INPUT expects all major small-system vendors to offer extensive remote support services by 1989. RSS is important to vendors because it reduces on-site service costs while improving overall service performance. Users, on the other hand, are considerably more reserved in their attitudes about being involved in remote support. (Users ranked RSS at 5.6 on a scale of one=unimportant and ten=very important, in a recent survey conducted by INPUT).
- Exhibit V-8 lists the various advantages and disadvantages of remote support as reported by small-system users and vendors.
- The importance of RSS could take on additional significance in the future as it affords the vendor protection from TPM competition. This protection will be based primarily on proprietary software developed for the diagnostic/repair process. Several vendors noted that TPM competition would have to expend substantial sums of R&D capital in order to develop an RSS capability. This provides the vendor a considerable competitive advantage over TPM vendors.
- Sixty-three percent of the small-system vendors interviewed indicated that they expected extensive growth in remote support services by 1989. Vendors typically believe that users will become more involved in the RSS process as a way to improve service. Vendors must realize that--as shown in Exhibit V-8--users may not be ready to accept RSS wholeheartedly.
- One point that INPUT continues to stress about remote diagnostics (and remote support, in general) is that the vendors must market these service/system capabilities. Many users still resist using remote support because they do not understand the benefits. However, INPUT has found that when users experience the benefits of remote support (e.g., improved response time or increased system availability), they became converts and almost refuse to accept traditional on-site service.

EXHIBIT V-8

SMALL-SYSTEM USER AND VENDOR ATTITUDES TOWARD REMOTE SUPPORT

VENDOR ATTITUDE	
RSS COMPONENT	PERCENT VENDORS
Improves Response Time	63%
Improves Repair Time	75
Increases Uptime	50
Decreases Work Force Levels	25
RSS COMPONENT	PERCENT USERS
Advantages	
Improves Response/Repair Time	46%
Increases Support Levels	26
Convenience	12
Disadvantages	
Reduces Person-to-Person Contact	33
Insufficient Security	31

2. THE DEVELOPMENT OF FAULT-TOLERANT SUBSYSTEMS

- Fault-tolerant and redundant technology has been most readily applied in the small-system environment for several reasons:
 - Small systems are less expensive and therefore are not as great a drain on the user's financial resources as mainframes. (This reason was particularly true in the early 1970s when "redundant system" meant one CPU was unused, acting only as a back-up to the primary CPU.)
 - The market, even today, is not large by mainframe or minicomputer standards.
 - Established mainframes vendors were already committed to standalone technology.
- Despite or perhaps because of the fact that most vendors chose not to enter the fault-tolerant market, companies such as Tandem and Stratus have been growing rapidly into a market that could equal \$13 billion by 1987. But more important for the purposes of this report, redundant and fault-tolerant technology will have a tremendous impact on service.
- Some small-system vendors, such as Four Phase, are already applying fault tolerant and component self-diagnosis technology to their systems with impressive results. The number of functioning circuit boards replaced by field engineers fell by almost 70% and parts testing and inventory costs were reduced as were parts testing and transportation.
- Service on fault-tolerant systems will be considerably different than on conventional systems because of the resident self-diagnostics resulting from redundant component technology. Fault-tolerant systems will usually require less technical training for the FE and more component exchange activities. INPUT expects fault-tolerant systems to lead the market in the application of remote diagnostic, remote fix technology.

- As the market for redundant systems and fault-tolerant technology grows, there will be a corresponding decrease in the necessity for unscheduled CPU maintenance. Individual CPU failures will still occur (although with less frequency than now), but these failures will be unnoticed by users, due to the efficiency of multiprocessor tasking. The vast majority of repairs will be attended to during scheduled maintenance periods.
- A much more efficient allocation of service resources will result from the scheduling of maintenance calls. Currently, this is not possible even on fault-tolerant systems because of the general lack of system reliability. However, as modules of multiprocessors grow, the failure of one CPU will not require immediate service because system performance and data integrity will not be improved.

3. INCREASED SYSTEM MODULARIZATION

- The growing trend toward modularization in the small-system environment will have a significant impact on service in the future. This impact will be felt primarily in two major areas. First, as noted above, individual modules will be self diagnosing. Rather than repairing these modules, vendors will send relatively unskilled technicians to replace parts or the users will replace the parts themselves.
- The second important impact of modularization will be in the area of compatibility of peripherals without a major product line. DEC, for example, has ensured peripheral compatibility for its PDP and VAS lines of mini- and superminicomputers. This improves the overall system attractiveness to the user and allows for a certain stability when servicing total systems.
- Modularization leads to—in the eyes of many vendors—increased user participation in maintenance. Stratus Computers, for example, expects their users to become involved in maintenance even though Stratus offers one of the most

sophisticated remote diagnostics and support packages on the market. As noted above, over 40% of small-system vendors expect their users to become more involved in maintenance. Increased modularizations will make this increased involvement possible.

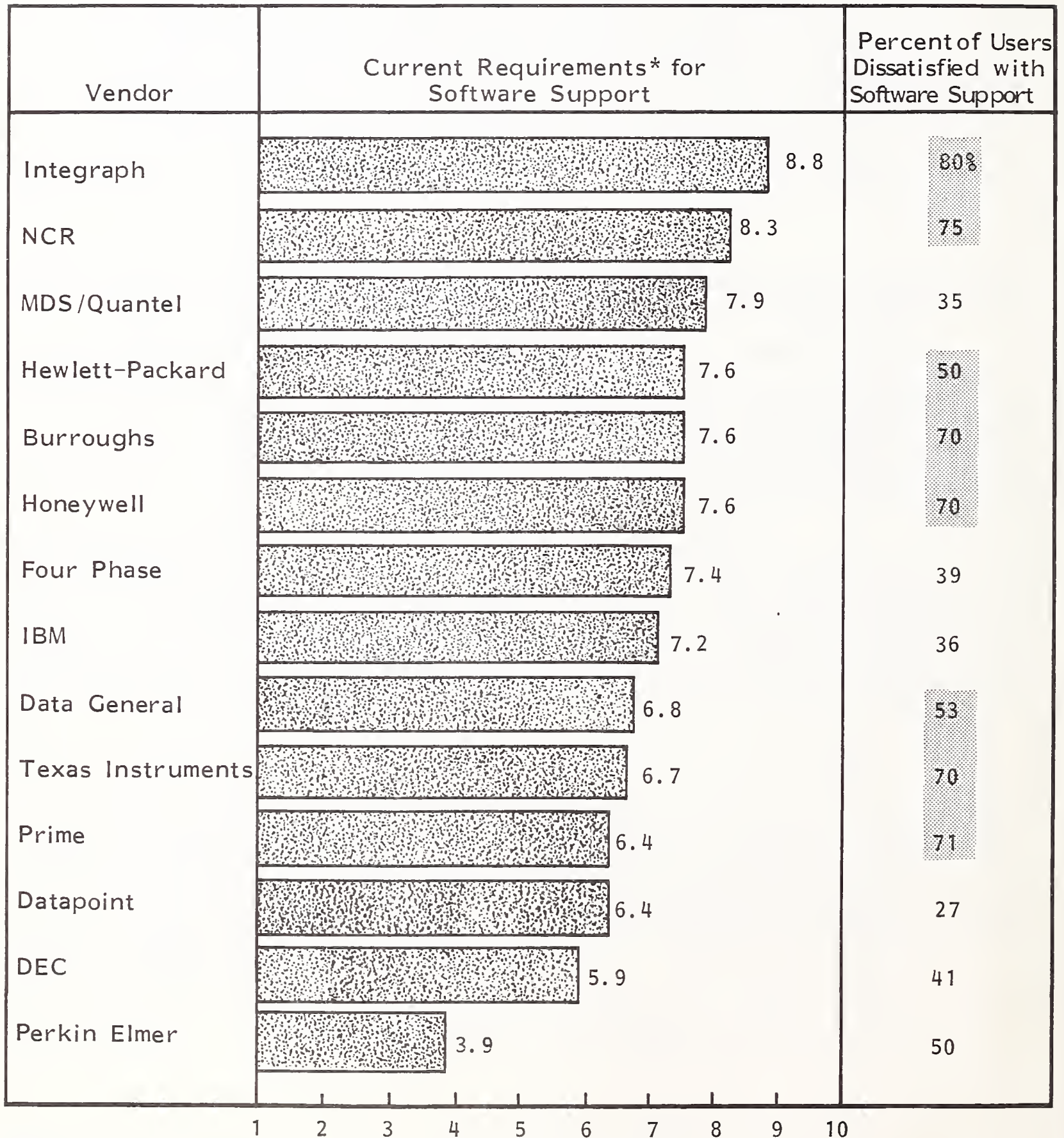
- Overall, INPUT expects small-system hardware maintenance price to fall as a result of competitive pressure (primarily from DEC and IBM) and from user demands for lower prices. Vendors must not ignore this trend or they will experience an erosion of small-system service profitability. INPUT recommends the following hardware service strategy to compensate for lower service prices.
 - Initiate cost reduction plans particularly with the goal of reducing on-site service expenditures.
 - Segment the user base and understand each group's needs. With the advent of the supermini, many vendors are neglecting their traditional 16-bit minicomputer users. This is a very substantial revenue source that should not be neglected or taken for granted.
 - Redesign hardware service contracts so that they more accurately reflect user needs. In some cases, users are willing to pay additional fees for selected services--vendors should know what those services are.
- Most importantly, small-system vendors must accept the fact that hardware service is becoming more competitive and that, for continued overall service revenue growth, new sources of revenue must be found. One of the most significant sources of small-system service revenue in the future will be software maintenance and support.

C. SYSTEMS SOFTWARE SERVICE TRENDS

- The real competitive advantage of the traditional minicomputer was that it was relatively inexpensive and relatively easy to use in comparison to state-of-the-art mainframes. Minicomputer vendors did little or no software design or support but rather depended on a multitude of independent software vendors. This traditional low-end market, however, is being eroded by micro- and supermicrocomputer vendors and minicomputer vendors have been forced to expand services--particularly system software support--in order to maintain market share.
- Exhibit V-9 demonstrates the high level of dissatisfaction expressed by small-system users with the system software support they are receiving from minicomputer vendors. Dissatisfaction rates ranged from 80% (Integraph) down to 27% (Datapoint). Overall, 59% of all small-system users indicated that they were dissatisfied with the software support they are receiving from their minicomputer vendor.
- The major complaint most small-system users have with software support is the inability of the vendor to fix errors in a prompt and timely manner. Exhibit V-10 shows that users regard fixing errors as the software support function most in need of improvement. Other support areas such as consulting and adding new enhancements need to be improved, but the users already do not regard these functions as high priority areas.
- Software support currently provides both a challenge and an opportunity to small-system vendors. The challenge is that today's minicomputer is often a powerful interactive system that is placing a greater burden on system software than ever before. The opportunity is that small-system users are finding software support so important that they are willing to pay substantial premiums to get the support they require.

EXHIBIT V-9

USER REQUIREMENTS AND CURRENT LEVEL OF SATISFACTION WITH SMALL-SYSTEM SOFTWARE SUPPORT

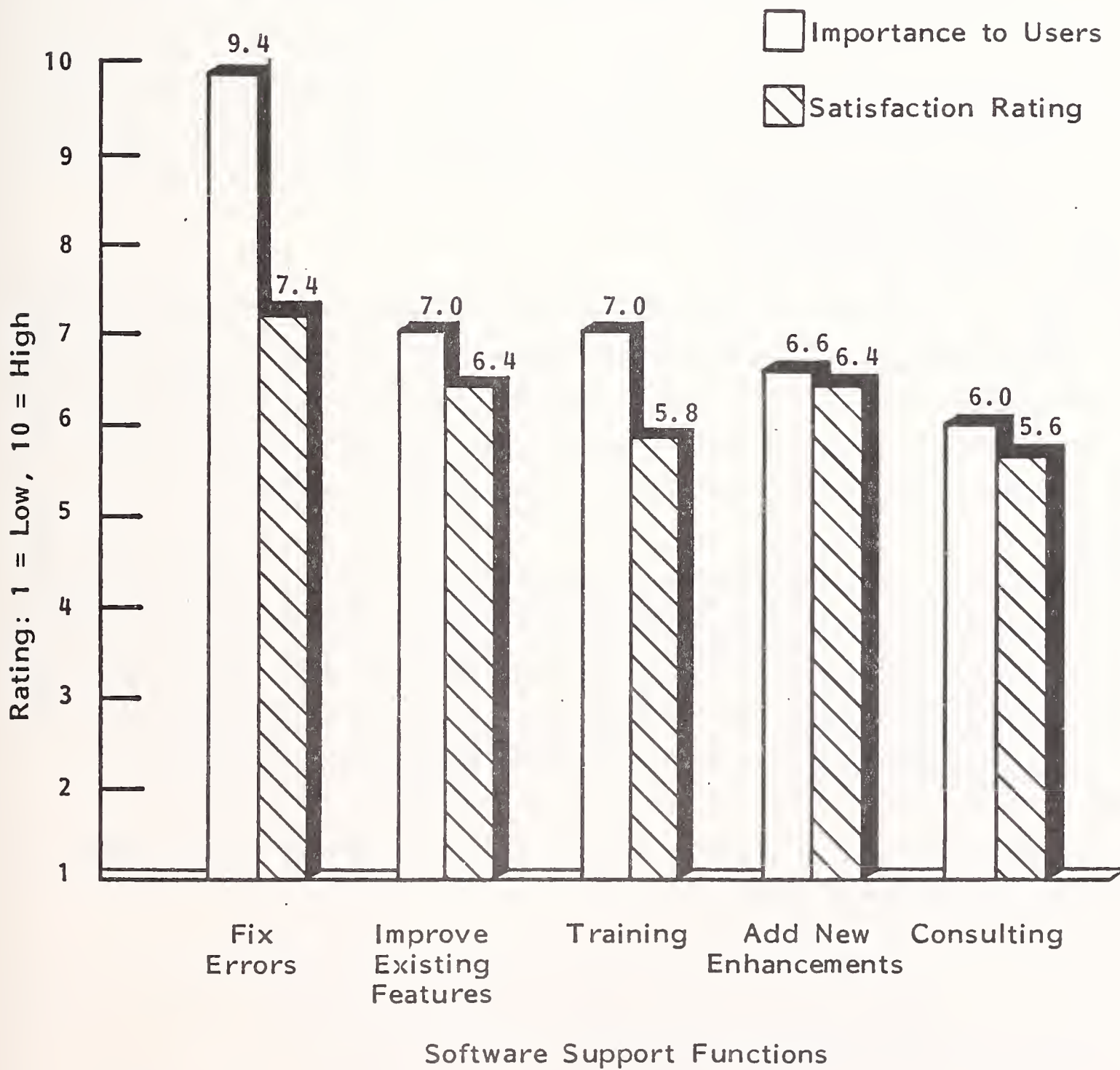


 Over 50% of Users are Dissatisfied with Software Support

* Based on a Scale of 1 to 10, 1 = Low, 10 = High

EXHIBIT V-10

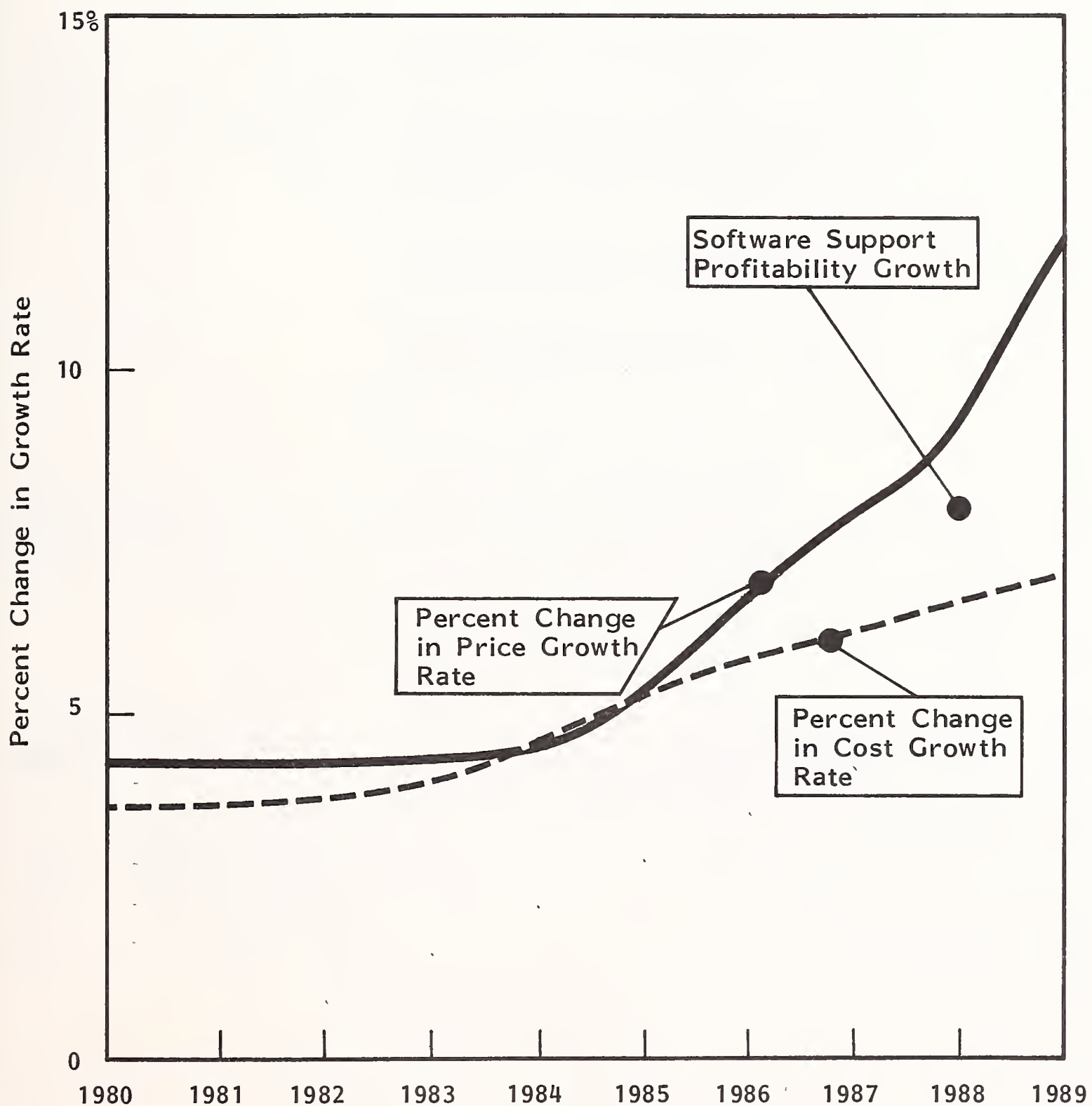
SMALL-SYSTEM USER RATINGS OF SOFTWARE SUPPORT FUNCTIONS



- Small-system vendors--particularly superminicomputer manufacturers--can look to the mainframe for the shape of things to come in systems software support. Although the actual hardware continues to get larger and faster, the systems software is becoming more complicated and relatively less efficient. Less than 10% of mainframe execution time, for example, is spent running user written code. The remainder of the time, the processor is busy driving the operating system or a data base management subsystem.
- Many of the small-system vendors will find an increasingly complex operating system much to their liking. Since the operating system requires a larger and larger portion of the processing power of the machine, users will be forced to purchase more and larger CPUs. In addition, a complex operating system makes it difficult for the user (or independent vendor) to displace the manufacturer; the operating system, even more than the hardware, ties the user to the vendor and vice versa.
- As a result of the growing complexity of systems software and the obvious user demand for increased software support, INPUT expects overall software support revenues to increase from \$300 million in 1984 to \$984 million in 1989--an average annual increase of 27%. By 1989, software support will equal almost one quarters of all small-system service revenues.
- Exhibit V-11 demonstrates that the growth in the cost of systems software support is expected to increase between 1980 and 1989, but that the increase is not expected to be dramatic. There will, however, be a substantial increase in software support prices which will cause a rapid increase in software support revenue and overall service profitability.
- Price increases in software support will be supported by the market for several important reasons:
 - Users, as noted above, are becoming increasingly dependent upon vendors' support of software.

EXHIBIT V-11

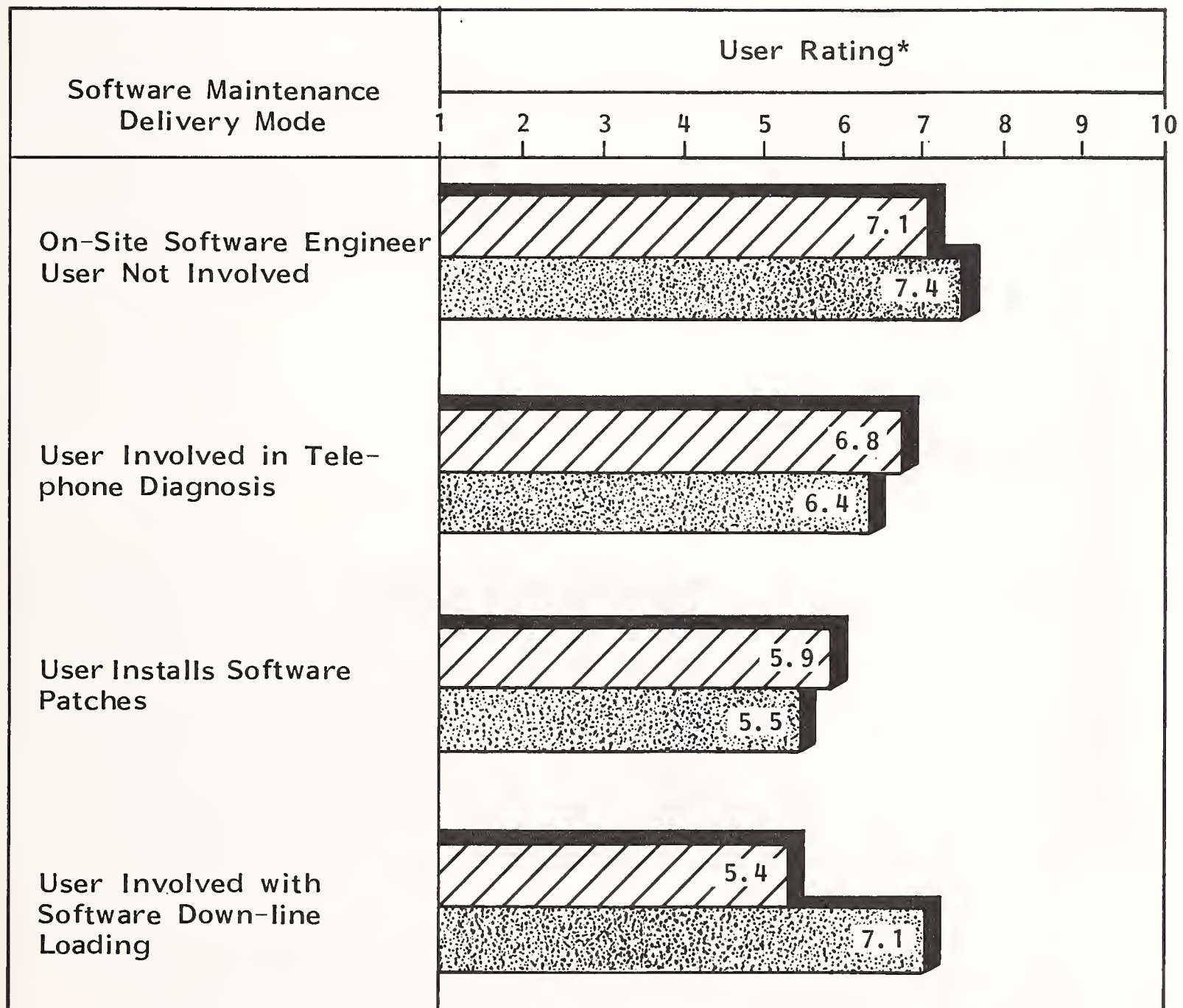
MINICOMPUTER SYSTEMS SOFTWARE MAINTENANCE AND
SUPPORT GROWTH RATES, 1980-1989



- Systems software is growing in complexity--users and independent vendors cannot adequately support their own installed system software.
- Operating systems software is being combined with sophisticated data base management subsystems to create elaborate interactive systems software packages. These systems/DBMS software packages are becoming very popular and can be supported by only the largest manufacturers and independent software vendors.
- Although most software support profitability will result from price increases, vendors must be careful not to allow costs to get out of hand. Reducing software support costs, or at least stabilizing the growth of costs must be effected if vendors are to enjoy maximum profitability. Two cost areas to which vendors must pay particular attention include:
 - Changing customer requirements for support.
 - Organizational structure for software support.
- Changing customer requirements for software support is highlighted by Exhibit V-12. Users are, in general, more inclined to become involved in selected aspects of software support now than in the past. There is less of an emphasis on the traditional method of on-site software support.
- Vendors should be careful to try to involve users in only those areas that require limited technical skills. Ninety-five percent of small-system users, for example, currently will install new releases of software, while only 16% will attempt to modify the vendors' software. As Exhibit V-12 demonstrates, most users don't even want to be involved in installing vendor-produced patches to their software.

EXHIBIT V-12

SMALL-SYSTEM USER RANKINGS OF SOFTWARE SUPPORT DELIVERY MODES



 1984
  1989

Rating: 1 = Low, 10 = High

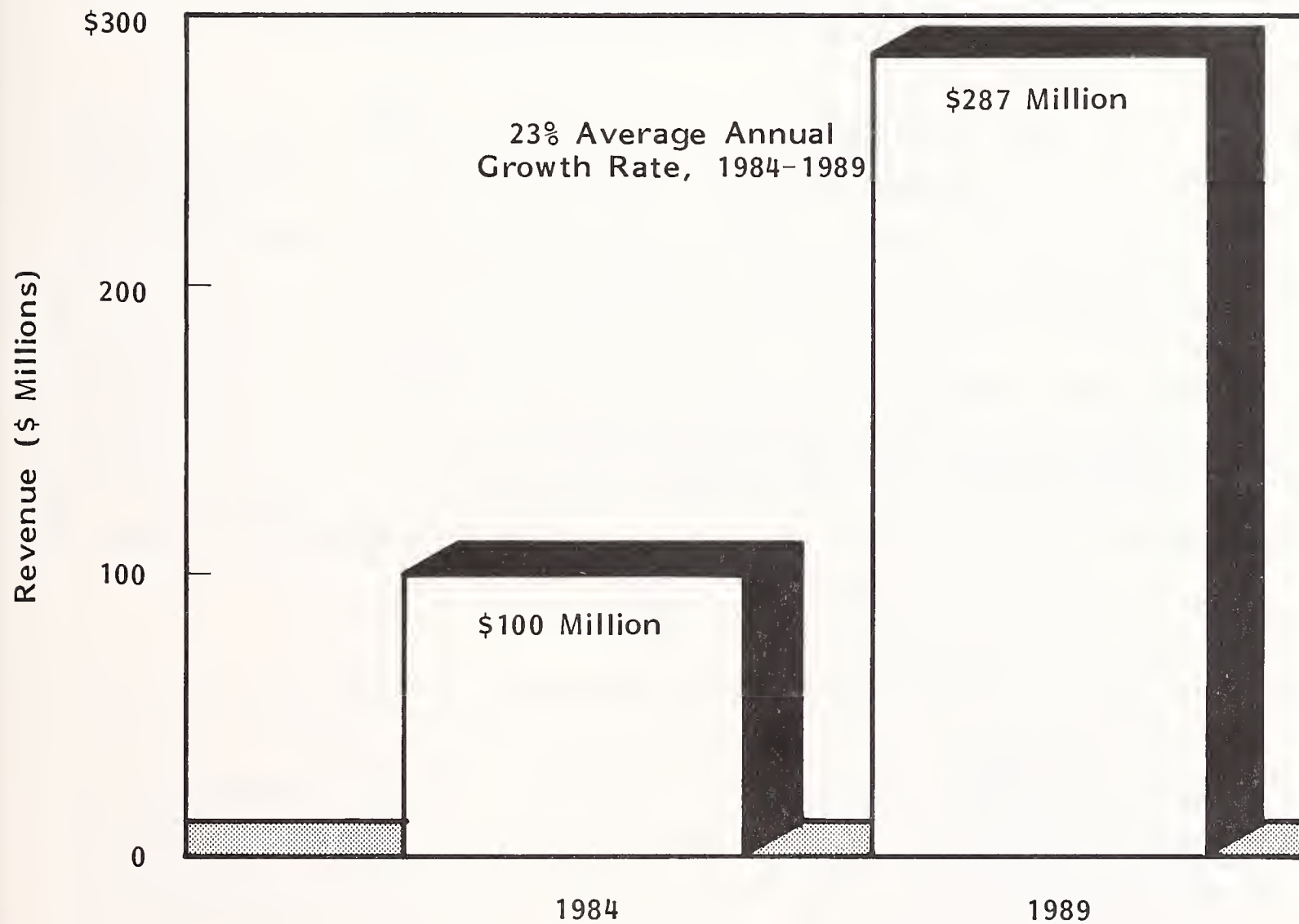
- The second major area that vendors must watch is in the design of the organizational support structure for systems software. Some vendors have software support distributed over a variety of departments such as marketing, research, and hardware maintenance. INPUT does not believe that this type of organization is efficient or effective in meeting user needs for software support.
- INPUT recommends that small-system vendors integrate software support into an overall service department in order to provide users with a single point of service within the company. The vendor will benefit because this type of organizational structure makes the most efficient use of labor and capital resources. In addition, a centralized software support group can interact simply and effectively with both the user and the in-house software R&D group.

D. PROFESSIONAL SERVICES

- Although professional services currently represents one of the smallest revenue sectors in the small-system service market, it is INPUT's belief that this submarket will be one of the keys to the long-term success in the area of customer service. Currently, small-system professional services generate only \$100 million, as shown in Exhibit V-13. However, this number is expected to increase 23% per year; resulting in revenues of almost \$300 million in 1989--7% of the entire service revenue in that year.
- Even at \$300 million, professional services will not represent a significant portion of 1989 small-system service revenues. However, the relatively small revenue derived from professional services belies the importance of this service submarket. INPUT expects professional services to contribute to long-term small-system service growth in three main areas:

EXHIBIT V-13

SMALL-SYSTEM PROFESSIONAL SERVICES
REVENUE GROWTH, 1984-1989

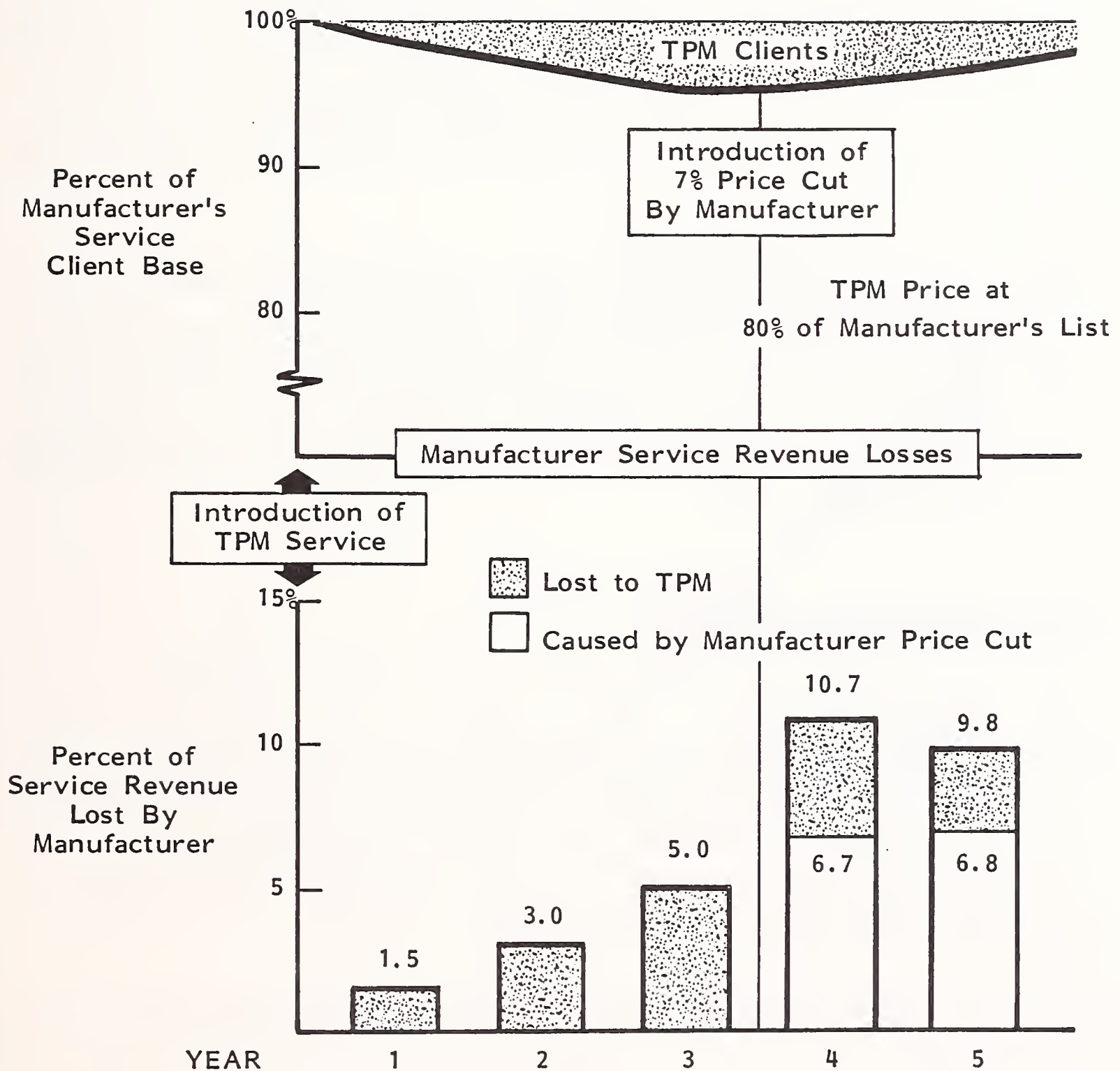


Professional Services will be Used to Differentiate Service Vendors
and to Increase User Service Product Loyalty

- Professional services will help vendors to differentiate their service products from competitive service vendors.
 - Capacity management, financial and systems planning, and other professional services will be instrumental in increasing sales of equipment.
 - Professional services are individually applied to each user and therefore result in a high level of user satisfaction with service.
- Of the three contributions mentioned above, the most important is that professional services will help vendors to differentiate their service products. Service product differentiation will be particularly important at the low end of the minicomputer market where TPM vendors are very price competitive. In many cases the manufacturers cannot and should not attempt to compete with these low-price, single-service TPM vendors. As Exhibit V-14 demonstrates, in order to compete with a low-price TPM vendor, manufacturers must also lower service prices. By lowering service prices in order to compete with the TPM vendor, the manufacturer regains market share but loses overall service revenue.
 - In essence, Exhibit V-14 shows that an attempt to regain 5% of the base by reducing prices on the remaining 95% makes no sense at all. Manufacturers must price their service based on a full range of product rather than just one (usually hardware) service. Some of the most successful small-system vendors, such as IBM, DEC, and HP, have recognized that the most effective competitive stance is not necessarily based on price, but rather on a full array of services which represent value to the user.
 - Professional services will also contribute to growth in equipment sales as vendors use site management, planning, and system design services to improve accounts control and reduce competitive comparisons. Service vendors that act as site managers have the advantage of knowing what the users require

EXHIBIT V-14

TPM IMPACT ON MANUFACTURER SERVICE REVENUE



and, perhaps more importantly, how new equipment acquisitions are budgeted for. This places the full service vendor at a considerable advantage over competitors and improves user satisfaction as well.

- Professional services will never represent a major profit center on the order of software or hardware maintenance, but it will contribute to overall profitability via increased equipment and service sales. Exhibit V-15 shows a steady growth in both service prices and costs through 1989. This growth will result from a substantial increase in user demand for professional services such as multisystem integration and consulting, system design, site management, and planning.
- In addition to specific services, there will be substantial growth in small-system professional services as vendors enter new markets (e.g., office automation) which require extensive nontechnical services. Professional services will represent the most important competitive advantage small-system vendors have in combating low-price TPM vendors and high-performance minicomputer products.

E. EDUCATIONAL SERVICES

- Education and training in the small-system environment is currently a relatively minor subset of the entire service market. However, INPUT expects this to be one of the fastest service sectors through 1989. As Exhibit V-16 demonstrates, educational services revenue will increase 29% per year, from \$80 million in 1984 to \$287 million in 1989.
- The growth in educational service revenues will result from three major factors:

EXHIBIT V-15

SMALL-SYSTEM PROFESSIONAL SERVICE PRICE VERSUS
COST GROWTH, 1980-1989

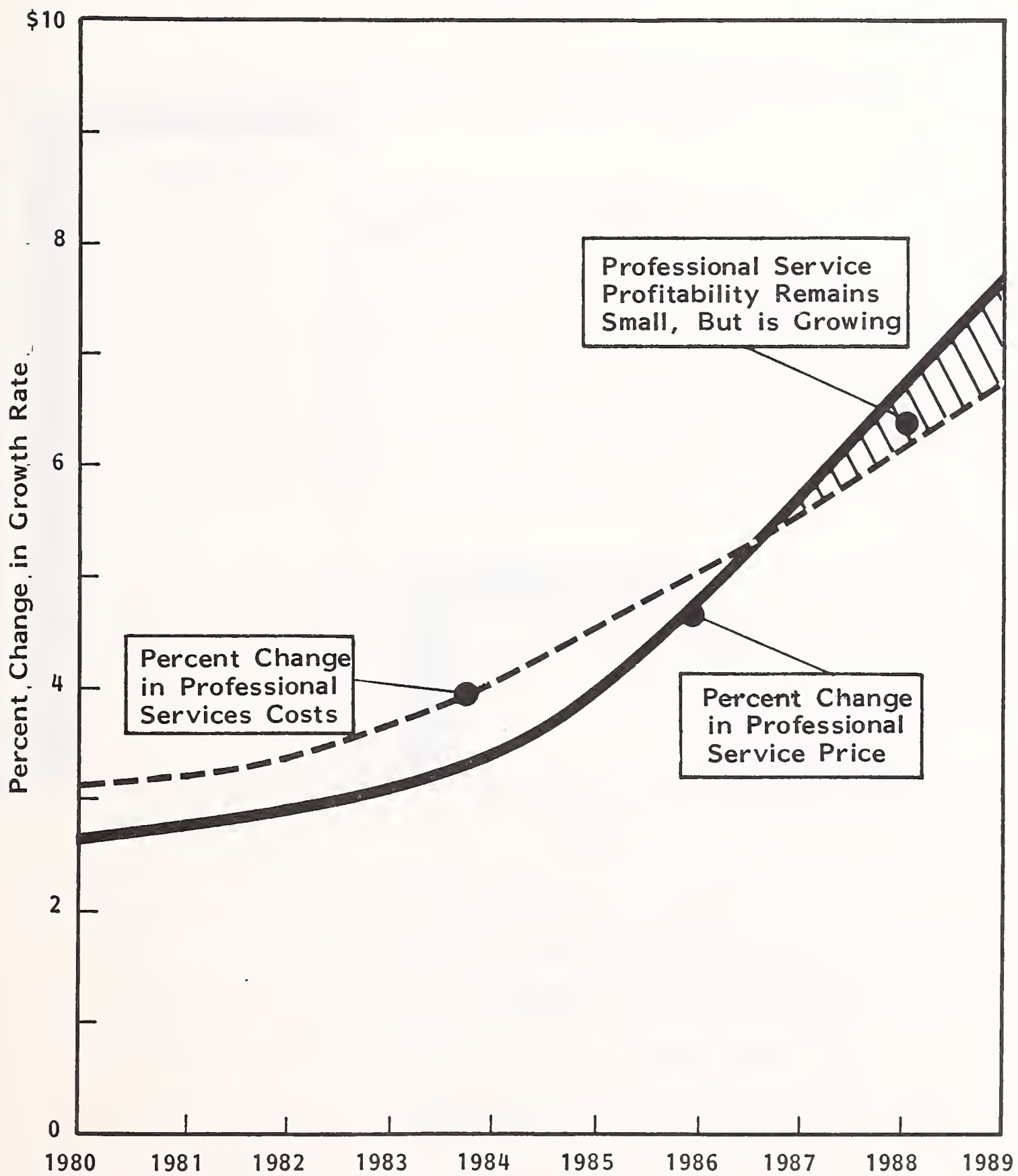
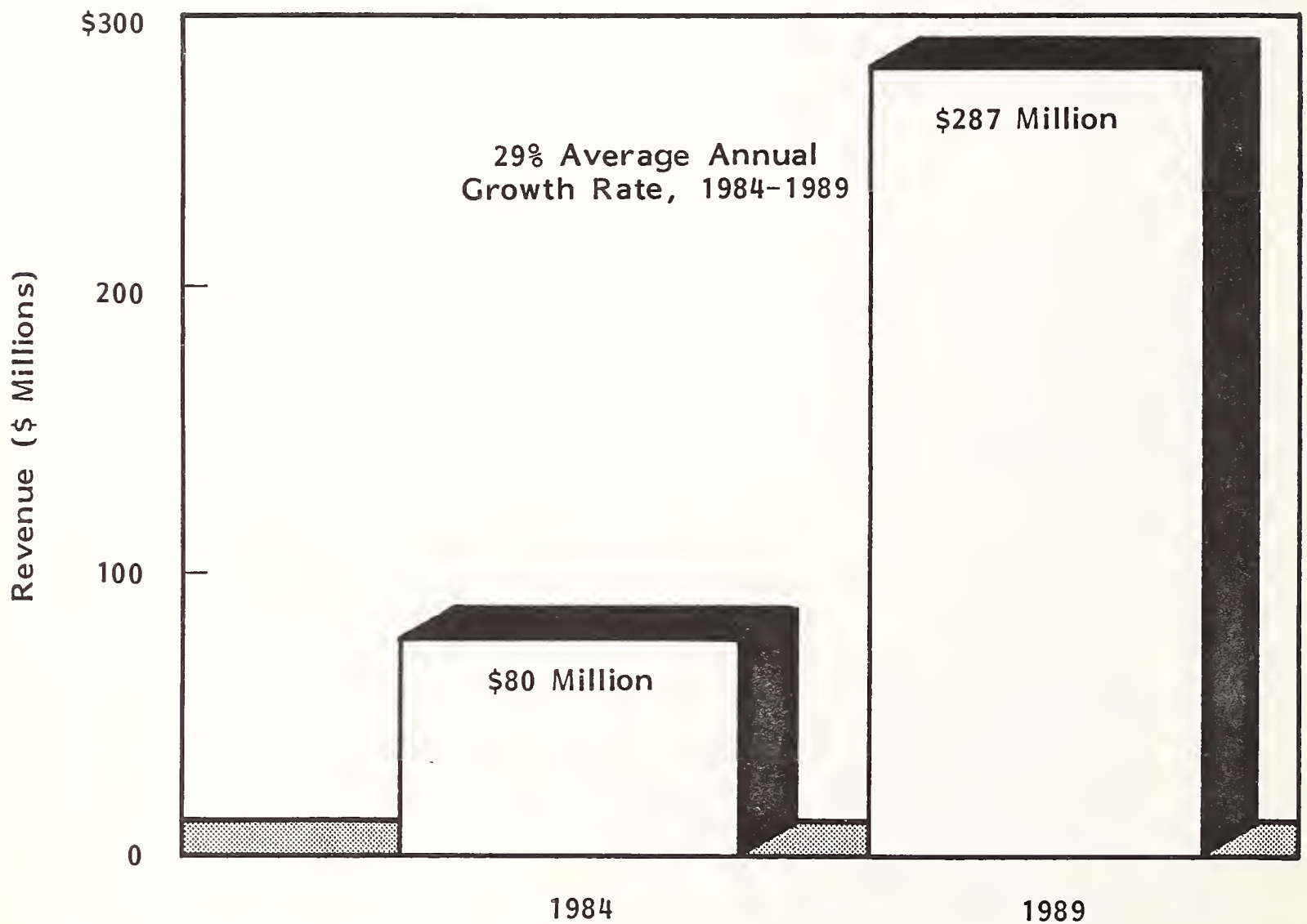


EXHIBIT V-16

SMALL-SYSTEM PROFESSIONAL SERVICES
REVENUE GROWTH, 1984-1989



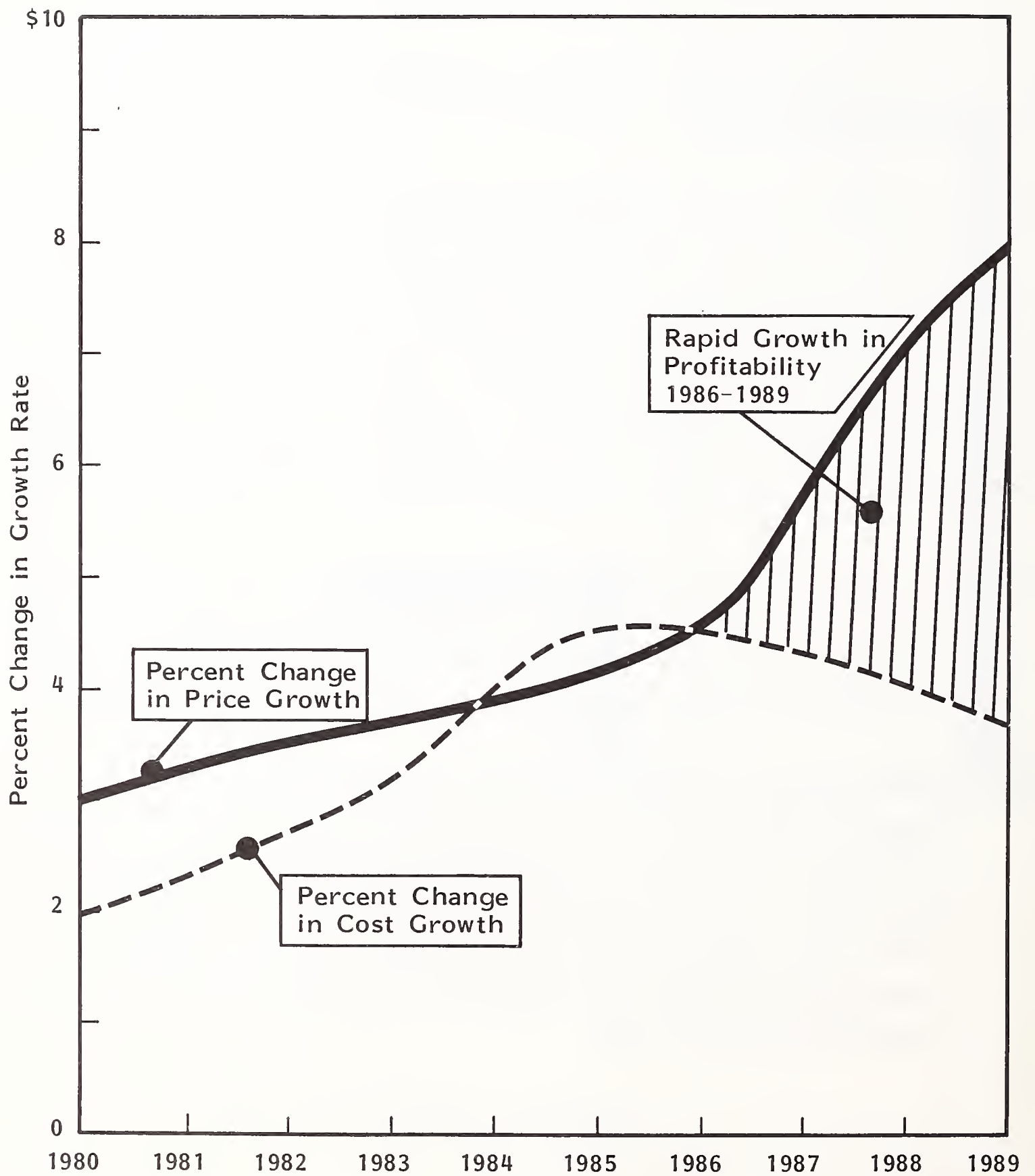
Factors Promoting Educational Services Growth

- Increased Customer Demand
- High Profit Margin
- Transportability between Products

- There will be a very substantial growth in customer demand for educational services, particularly as small-system vendors successfully reach new markets.
 - Training and educational services tend to be very profitable because they require little or no maintenance.
 - Educational services can be designed to be transportable between products opening up a variety of new markets.
- The growth in customer demand for training and education will result from customers trying to find new ways to increase employee productivity. Small business systems and traditional minicomputers are already having a tremendous impact at the departmental level and employers will be looking for new ways to expand this effectiveness down to the office level. One applications software vendor interviewed by INPUT indicated that training and education revenues grew by almost 40% a year—despite a negligible growth in sales—primarily on the strength of new training sales to the vendor's installed base.
 - As noted above, educational services tend to be very profitable mainly because they require little or no maintenance and can be easily adapted to a variety of new products. Profitability is even being improved with the advent of video, audio, and self-paced instruction that results in lower labor costs.
 - Profitability of educational and training services will also be impacted by the economic efficiencies inherent in an expanding market. Exhibit V-17 demonstrates that there will not be a dramatic increase in the price of educational services, but that costs will decline after 1986 and continue to do so through 1989. In fact, there will be an actual decline in the cost of development or administration of educational products, but the costs will be distributed over a substantially larger user base.

EXHIBIT V-17

SMALL-SYSTEM EDUCATIONAL SERVICE GROWTH, 1980-1989



- INPUT believes that educational and training services should definitely be integrated into the service department. While some companies have set up separate training departments, INPUT believes this is a mistake for the following reasons:
 - Training is likely to be an ongoing function that constantly involves both hardware and software maintenance personnel.
 - There must be a great deal of synergy between education and maintenance/support in order to reduce user-instigated system failures.
 - Education and training, like all after-sales support services, should be combined into an overall maintenance/support group in order to optimize user requirements for add-on services.

F. PRICING OF SERVICES

- The small-system service market is unique in that it encompasses such a wide variety of users and markets. Unlike the mainframe market, which is well defined in terms of processing needs, or the microcomputer market, which is aimed at the individual, the minicomputer serves almost all market sectors. Traditionally, microcomputer vendors have remained successful by understanding the needs of their users and remaining flexible enough to meet their needs.
- INPUT expects that the small-systems market will become even more fragmented in the next five years and consequently, vendors will have to be even more flexible in the future--particularly in the area of service pricing. INPUT has found that most small-system users are satisfied with current service prices, but there is a substantial (and growing) minority of users that expect discounts or are willing to pay premiums for different levels of services.

- Exhibit V-18 demonstrates the current service price segmentation of small-system users. A large minority (20-25%) of small-system users reported that they would accept a lower level service if service prices were discounted. This group typically believed that some services were unnecessary, in their particular situation, or that less expensive forms of service, such as depot service, were adequate for their needs.
- The vast majority of users in Exhibit V-18 feel that standard maintenance is fairly priced. But this is not a homogeneous group; most small-system users typically demand better service in some areas, but will accept below average service in other areas.
- At the other end of the service spectrum, approximately 10% of the small-system users require a very high level of service quality--and they are willing to pay a premium to get the service they need. These users were willing to pay up to 45% over and above this BMMC for a higher level of service.
- A number of small-system vendors have attempted to adapt to the changing service requirements of their user base of making available optional service products, such as guaranteed repair time, spare parts availability, etc. Some of these new service products have been very successful. DEC Direct, for example, has been extremely profitable because it allowed DEC to tap a new market in supplies. On the other hand, service guarantees (e.g., repair time guarantees) have not been readily accepted by the user base.
- INPUT believes that even when vendors are flexible in offering a variety of service products, they must accurately assess the needs of the user base. Exhibit V-19, for example, demonstrates the typical small-system vendor's pricing policy for response time: four hour standard response time, with a two hour option (at a premium of 15-20%). As the exhibit shows however, this pricing policy ignores the users who require a discount and does not fully profit from users who occasionally require even better than two hour response time.

EXHIBIT V-18

SMALL-SYSTEM SERVICE PRICING RELATIVE TO OVERALL QUALITY

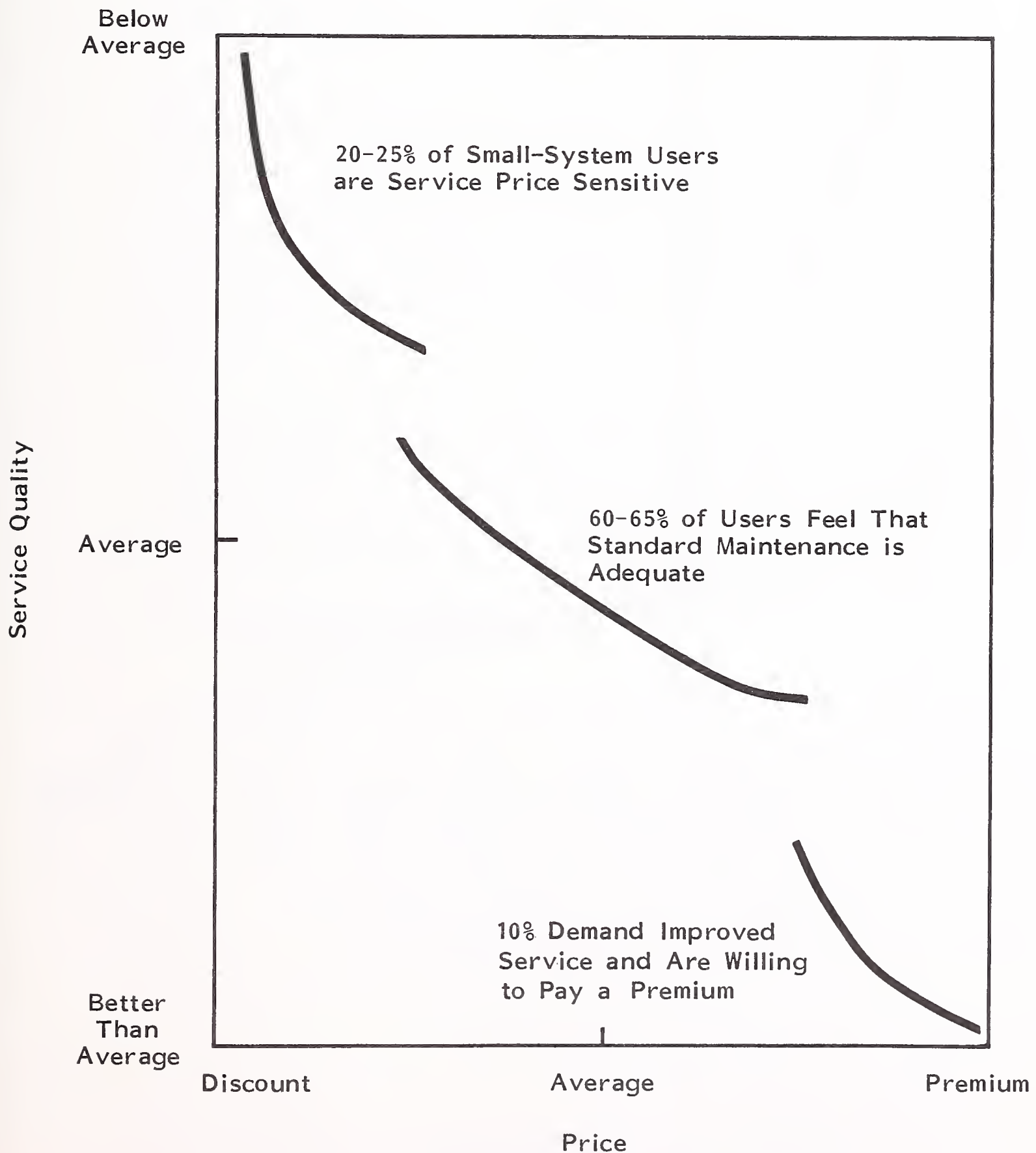
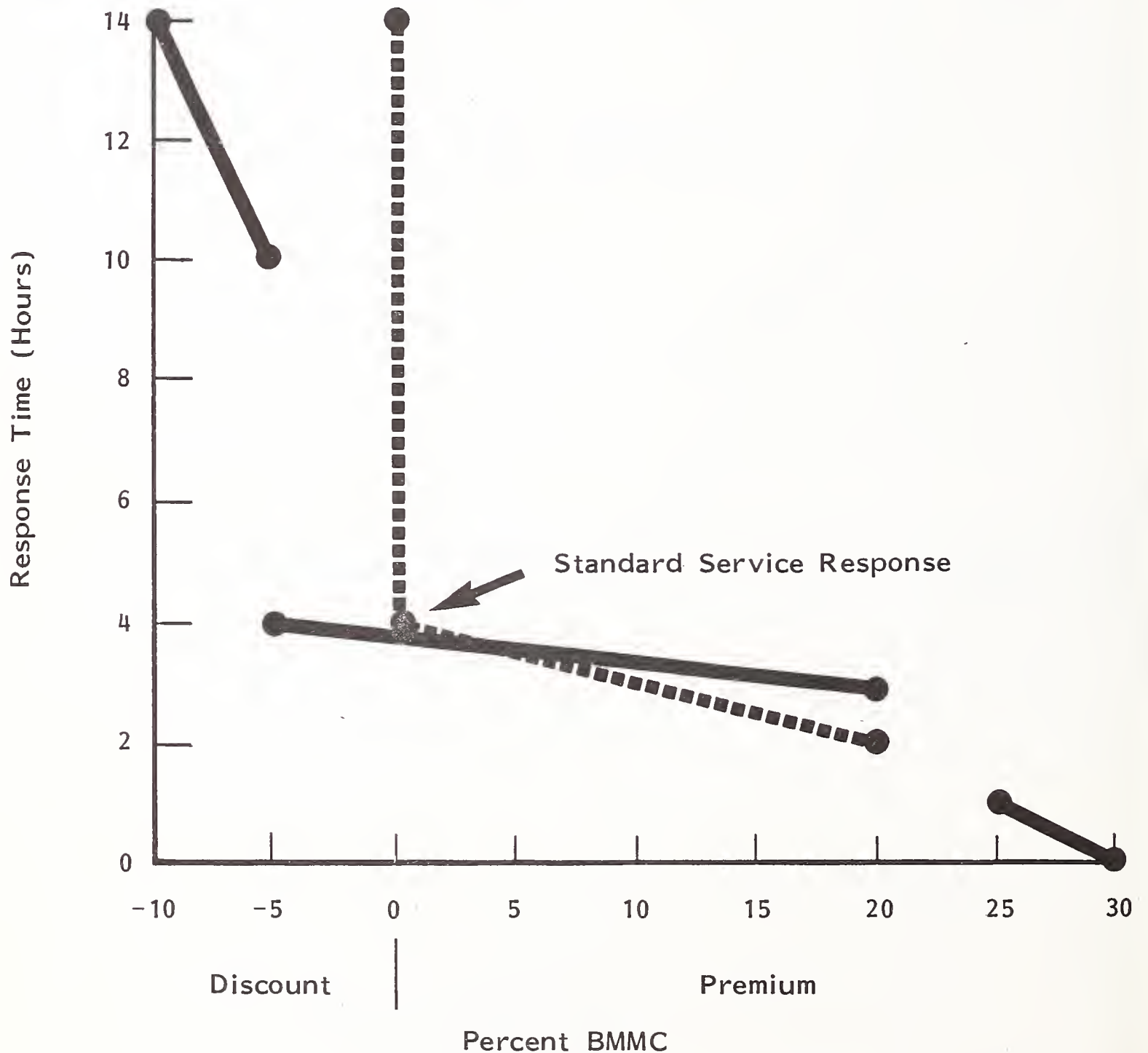


EXHIBIT V-19

SMALL-SYSTEM SERVICE PRICING RELATIVE TO RESPONSE TIME PERFORMANCE



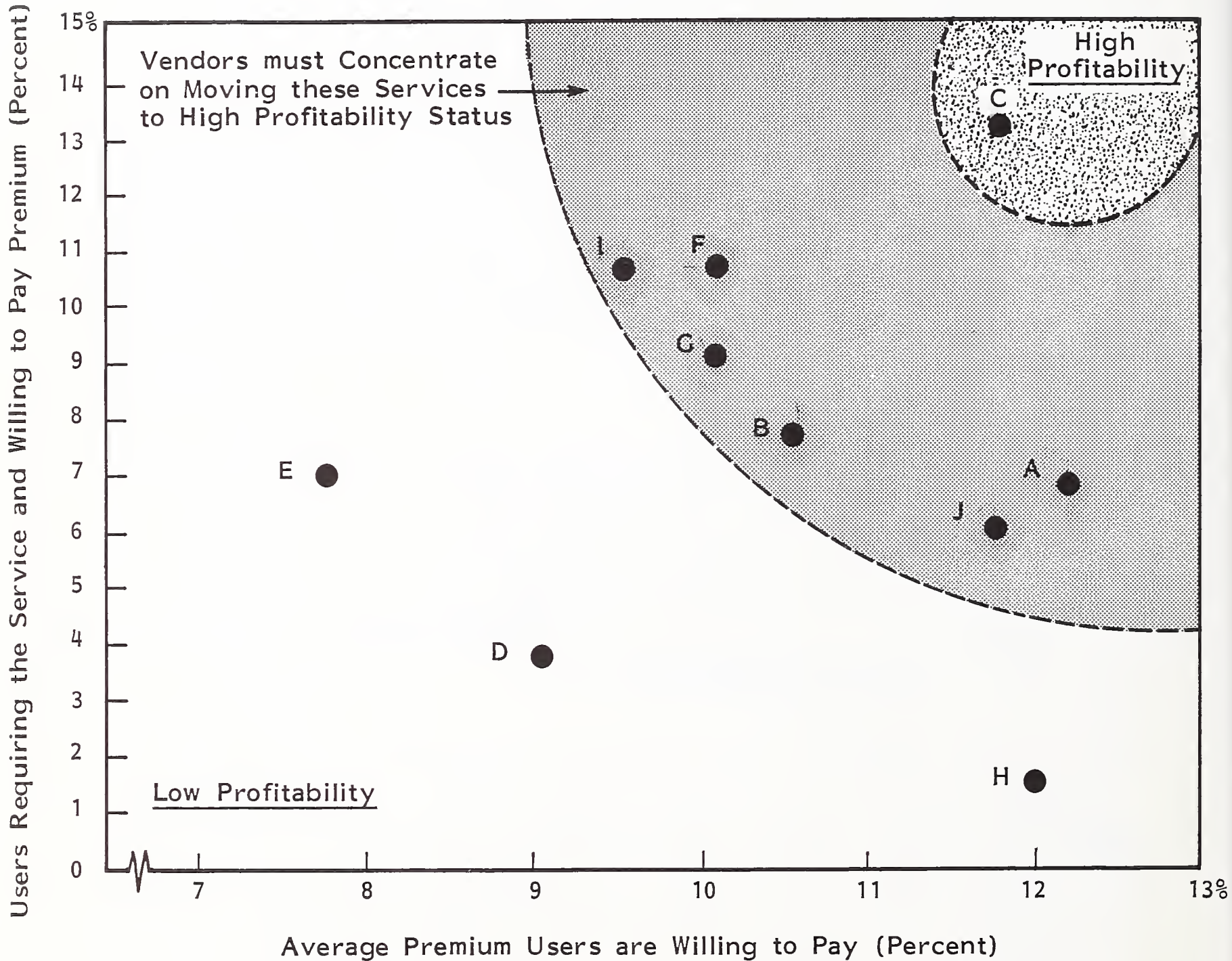
--- Typical Small-System Manufacturer Pricing Schedule

— Users Service Pricing Requirements Standard Service Response

- INPUT is not suggesting that service vendors design a service price schedule for each individual user, but rather that the vendor recognize that there are segments of users who are dissatisfied with the current method of service pricing. Users are looking for a greater service price flexibility on the part of the vendors; as the service business becomes more competitive, users will be much more demanding in their requirements for flexible service prices.
- The first step in maximizing service revenue is to establish a pricing structure that accurately reflects the needs of users. As noted above, INPUT has identified three groups of small-system users: price sensitive, price insensitive, and those that accept the current maintenance price structure. A maximized pricing structure must not only address the global needs of these three groups, but must also face the individual service requirements within each group.
- A measure of the importance users place on individual services is demonstrated in Exhibit V-20. Relatively few small-system users require some extended services such as remote diagnostics or on-site spares and those that do are not willing to pay high premiums. On the other hand, guaranteed response time is required by a large number of users who are willing to pay high premium for the service.
- Exhibit V-20 points out that vendors must identify the services required by users, and segment the user base into high profitability groups. In some cases, as in Exhibit V-20, the vendor will want to increase the number of users willing to pay a high premium for a service in order to maximize profitability. In other cases, vendors may actually want to decrease the use of a service in order to prevent additional losses. In either case, the essential point is that the vendor must understand user requirements for service before setting service prices.

EXHIBIT V-20

PROFITABILITY OF EXTENDED SERVICES



- | | |
|-----------------------------|--|
| A. Standby Coverage | F. PMs During Non-Prime Hours |
| B. Guaranteed Uptime | G. Occasional Shift Coverage |
| C. Guaranteed Response Time | H. Full-Time, On-Site FE |
| D. On-Site Spare Parts | I. Guaranteed Repair Time |
| E. Remote Diagnostics | J. Guaranteed Turnaround on Software Fixes |

VI CONCLUSIONS AND RECOMMENDATIONS

VI CONCLUSIONS AND RECOMMENDATIONS

A. INTRODUCTION

- The small-system service market is going to become much more competitive in the next three to five years as more manufacturers enter the TPM business and users' expectations for service continue to grow. In addition to these two major trends, the small-system service market will be affected by reduced minicomputer product life cycles, an increased number of new product introductions, and increased competition from both mainframe and microcomputer vendors.
- In order to compensate for the increased level of competition and change in the small-system service market, vendors must be prepared to develop long-term service strategies based on industry-wide trends rather than reacting to specific service issues. Identification of long-term service trends will be a difficult task because the trends are affected by so many extraneous factors. INPUT believes, however, that there are two major trends that will drive the market for the next five years:
 - Increased user expectations for improved service.
 - Reduced user loyalty to one vendor for service.

B. USER IMPACT ON THE SMALL-SYSTEM SERVICE MARKET

- Perhaps the most important trend in the service market as a whole, and small-systems in particular, is the growing influence users are exerting on the vendor's service-related decisions. The user's influence is growing as a result of two major factors:
 - Increased user sophistication regarding service (resulting from a growing dependence on their computer system).
 - A higher level of competition for the users service business from both the manufacturers and TPM vendors.
- Vendors must accept that the era of the passive service customers is gone and will, in all probability, never return. Users are becoming much more active in driving the market in areas like service pricing, flexible levels of support, response times, etc. While some vendors can take an "imperial" attitude and ignore user demands, the successful service vendor will attempt to understand the user's needs and design the company's programs around those needs.
- Currently, the most pressing user demand for service improvements are in the area of software support. Over 54% of small-system users are dissatisfied with the service they are receiving in this area; some users reported that their vendor's overall repair time (response and repair time) was over 100 hours on service software problems.
- INPUT recommends that vendors take an aggressive stance on supporting software (primarily system software). As shown in Exhibit VI-1, one of the first steps in improving software support is to integrate software maintenance into the Customer Support Program. INPUT is not suggesting that vendors cross-train hardware and software engineers--on the contrary, INPUT believes that specialization is the key to profitable service. However, it is important that users perceive that they have a single source of report.

SOFTWARE SUPPORT — VENDORS MUST IMPROVE SERVICE

- **Integration of Software Maintenance into Customer Support Program**
- **Increased Remote Support**
- **Greater User Involvement in Software Maintenance**
- **Development of Software Data Bases for Access by Users**
- **Combine System and Applications Software Support into One Department; Increase Support for Applications Software**
- **Consolidation of Software Support into National Service Centers**

- Although cross-training is not necessary, hardware and software engineers must work together effectively so that users feel that they have one central support group solving problems. Users that suffer from "finger-pointing" between hardware and software support departments have, on average, the lowest satisfaction rate of all customers interviewed. Conversely, vendors who have successfully integrated hardware and software support typically have the highest user ratings in the industry.
- A consolidated software support center--as opposed to regional centers--is recommended because of the efficiencies inherent in one central location. Vendors can provide a variety of different services economically from one location that they may not be able to offer if regional centers were used. For example, one small-system vendor maintains a central support center in the same building with the company's software R&D staff; even the most minor software support problems can have a rapid turnaround time when the original programmer is available.
- Small-system vendors have often neglected another important software support resource--the end user. INPUT has found that many users will not object to becoming involved in their own software support, if they are given the proper support. User-accessible tools, such as data bases of software fixes or vendor sponsorship of user-group meetings can be very effective in both reducing software support calls and improving user satisfaction with service. Not all users will be interested in this option, but if the vendor segments the user base properly, substantial opportunities will come from encouraging some self-maintenance of system software.
- Hardware maintenance is an area in which users will expect substantial improvements in the future. Exhibit VI-2 lists what INPUT believes are the most important components of a successful adjustment in hardware maintenance. Essentially, the exhibit emphasizes that vendors must become more efficient in delivering hardware maintenance (i.e., cut down on on-site

SMALL SYTEM HARDWARE MAINTENANCE — INCREASE EFFICIENCY AND MAINTAIN FLEXIBILITY

- **Centralize Dispatching, Logistics Operations, and Remote Support**
- **Decrease Spare Parts Distribution Centers**
- **Increase Remote Support**
- **Expand Menu of Service Products**
- **Enhance Contrast Flexibility**
- **Unbundle Low-Demand Services**

repairs, increase inventory turnover, etc.) while at the same time becoming more flexible in meeting user needs. Low-demand services (e.g., annual site audits) should be unbundled from the basic service contract so that only those users that require the service will pay for it.

C. MAINTENANCE AS A COMMODITY

- The growth in competition among small-system maintenance vendors has provided the user with a variety of options for service from, among others, independent TPM vendors, the original manufacturer, and other manufacturers who are now entering the TPM market. As a result of this growth in service suppliers, small-system users are tending to view service as a commodity rather than as a specialized service to be provided by only one vendor.
- Users are regarding service in "generic" terms mostly at the low end of the small-system market. (Competition is so intense in the PC market, for example, that even IBM is having difficulty establishing a brand-name service identity.) It is at this low end that users are becoming most resistant to service price increases and most questionable in their loyalty to any one particular service vendor.
- Exhibit VI-3 demonstrates the process by which small-system service moves from specialized service to a commodity.
 - Hardware is becoming more and more reliable and this encourages users to think of maintenance as a declining need. In the not too distant future, fault-tolerant technology will provide users with a realistic opportunity to have 100% system availability. In this case, periodic maintenance becomes a necessary function, but will not dominate the user's planning process.

MAINTENANCE BECOMING A COMMODITY

- **Sharp Increases in Reliability Encourage Users to Think of Maintenance as a Declining Need.**
- **Service as "Commodity" Means:**
 - **Brand Name Loyalty Decreases**
 - **Service Market Opens to Competition, That in Turn . . .**
 - **Causes Pressure on the Price of Maintenance**
- **Equipment Manufacturers/Service Vendors Must:**
 - **Distance Themselves from "Maintenance Only" Image**
 - **Develop the Image of a Total Service Company**
 - **Integrate all Postsale Services**

- When hardware does not need to be repaired, users see fewer on-site repairs, and more component "swaps." As the skill level of the FE decreases, users typically see a reduced need to commit themselves to one particular vendor.
- Increasing competition has also led users to think of service as a commodity. Price-sensitive users started this trend, but as TPM vendors became more aggressive in promoting their cost-effective services, INPUT expects a growing number of large-system users to move away from comparisons based on the reputation of the service vendor, toward comparisons based on price of service.
- In order to withstand the pressures to lower service pricing (resulting from maintenance becoming a commodity), vendors must move quickly to distance themselves from a "maintenance only" image. Service vendors should integrate all postsale services into one department (particularly the Customer Services Department) in order to develop an image of a total service company.
- The primary advantage of offering a total package is that it allows the vendor to understand the user's needs and "control" the user's site. However, it is also important to note that the total service vendor will retain name and service product loyalty among users, while strictly hardware maintenance vendors will be forced to do business in an increasingly price-competitive market.
- In addition to site control, a total support package can contribute to overall service profitability. INPUT has found that even though users are becoming more resistant to hardware service price increases, there is little or no evidence that this trend is being carried over to other postsale support areas. In fact, INPUT has found that users are willing to pay premiums (over and above BMMC) of up to 50% for improved postsales support services like software support. Users have noted, however, a high level of dissatisfaction and a lack of support coordination between departments (i.e., finger-pointing.)

- INPUT recommends that large-system service vendors should accommodate user requirements for a single access point for all postsales support services. This type of support organization will not only improve user satisfaction but will also increase service revenues and profitability. In addition, by developing an image of a total support vendor, manufacturers will be able to differentiate themselves from the highly competitive, hardware-only service vendors.

D. EFFECT OF THIRD-PARTY MAINTENANCE ON THE SMALL-SYSTEM SERVICE MARKET

- As noted above, TPM vendors represent a serious competitive threat in the small-system market--so much so that vendors must differentiate themselves from these priced-based competitors. The small-system third-party maintenance market will grow to over \$350 million by 1989 and, although overall market penetration will not change dramatically, specific segments of the small-system service market (e.g., high population density, 16-bit processors) have clearly been targeted by TPM vendors.
- Overall, the TPM market is entering a new phase of renewed growth and market maturation. INPUT expects equipment manufacturers to become increasingly involved in the TPM markets. Initially this penetration will result as vendors try to use currently under-utilized service resources, but in the future TPM penetration will be based on the need to satisfy user requirements for multivendor service.
- As competition increases, there will be a major consolidation in the TPM market. We are already beginning to see increased interest in acquisitions (note the SORBUS acquisition by Bell Atlantic) as well as in mergers of mid-sized regional TPMs. This will affect the small-system service market by

making the remaining TPM vendors much more competitive particularly in the areas of geographic coverage and multivendor support.

- Despite the growth in TPM, equipment manufacturers still have huge advantages over independent third-party maintenance vendors. However, to ensure continued growth and profitability, the small-system manufacturers must exercise their competitive advantages over TPM vendors:
 - Emphasize the national service network with rapid access to parts and fast response time--two key areas that TPM vendors cannot always offer.
 - An established service infrastructure that allows the equipment manufacturer to add new service products at a low incremental cost.
 - Service technology in the form of remote support, test equipment, and regional repair facilities is much more highly developed by manufacturers than by TPM vendors. This provides the manufacturer with a substantial competitive advantage over the TPM vendor because the manufacturer will have a lower cost of service.
 - Manufacturers should not discount the importance of an established user base as a potential market for multivendor equipment services. By servicing "foreign" equipment in their installed base, manufacturers can increase user satisfaction with service, improve profitability, and protect their user bases from service competition.

E. LONG-TERM GOALS FOR SMALL-SYSTEM SERVICE SUCCESS

- Long-term success in the small-system service market will ultimately depend on a variety of factors such as installed base, development of new service

technologies, and profitability ratios. But even more important than these quantifiable factors are issues of service quality--are users satisfied with the service they are receiving and is the vendor meeting the user's need for service?

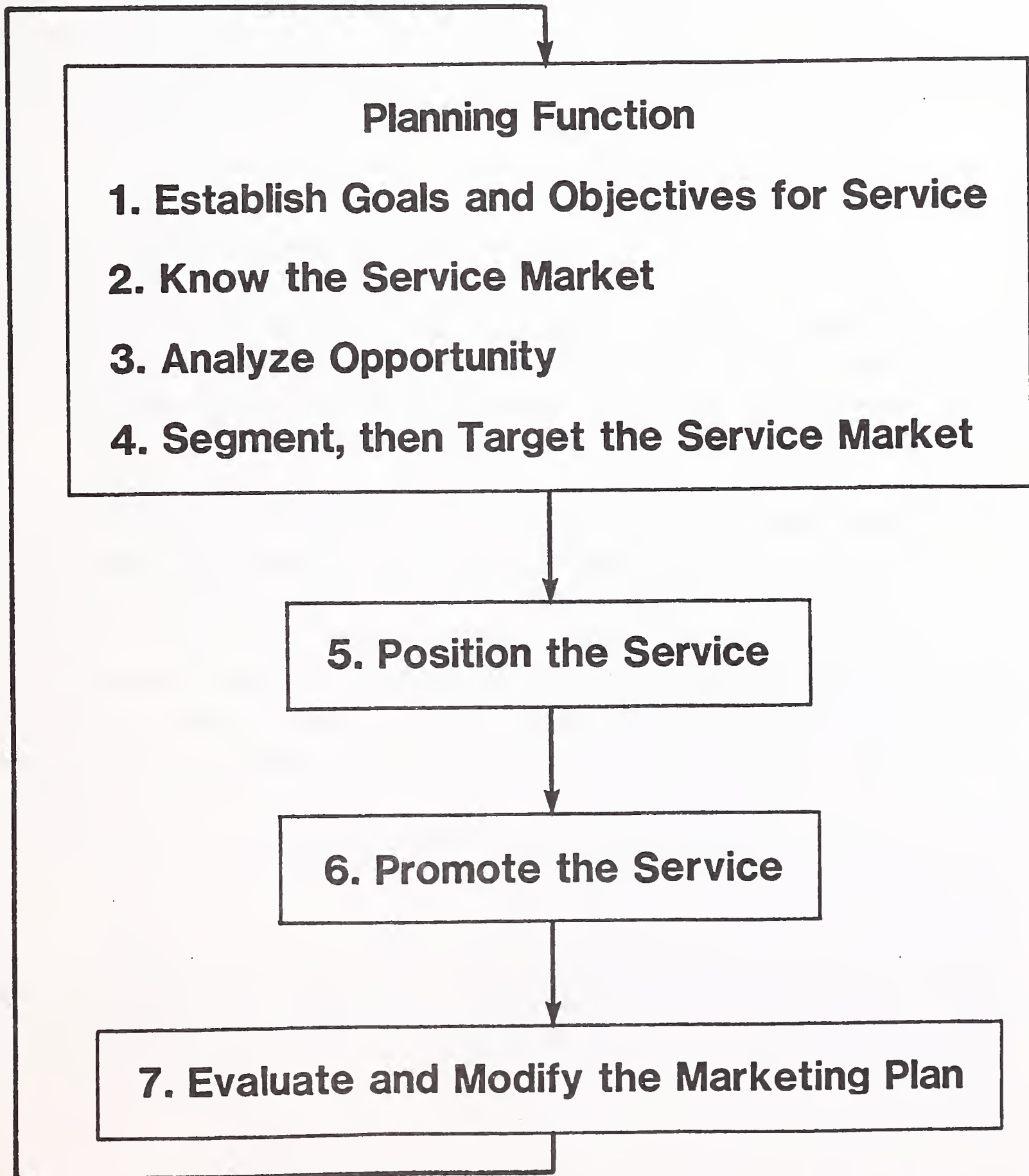
- INPUT believes that it is the qualitative issues which will ultimately determine if the vendor is successful in service. In effect, service profitability (i.e., success) will result first from understanding user needs and then meeting these needs as efficiently as possible. The most important step in understanding the needs of the market is to establish a service marketing plan.

I. MARKETING OF CUSTOMER SERVICES

- Most customer service organizations have a product-related service outlook. Vendors view individualized services (such as a two-hour response time or guaranteed 99% uptime) as individual products that can be sold to the customer. Traditionally, vendors have added individual services as needed to support the overall goals of the organization.
- INPUT believes that the product-oriented service vendor will not be able to maximize profits because it cannot react quickly enough to changes in the service market. First, the product-oriented service vendor must recognize the trend in user demands for service. Then the service must be designed and finally offered to the user. Typically, user demands for new services go unmet for a substantial amount of time, resulting in a dissatisfied user and lost revenue for the vendor.
- Small-system vendors are particularly susceptible to an overall product orientation because of their historic association with OEM vendors. The OEM vendor usually supplied a variety of integration and software support services leaving the equipment manufacturer to concentrate only on hardware maintenance.

- In order to react more quickly to user demands, INPUT suggests that vendors institute a service marketing approach that recognizes that customer needs and market characteristics are of primary importance to maximizing service revenues. In effect, INPUT recommends that vendors take a more proactive stance when marketing customer services.
- The purpose of proactive marketing is to understand user needs and then to design services that anticipate those needs; vendors should not introduce a service and then attempt to mold user performance in this area.
- A proactive marketing plan is by nature a long-term plan. Overall market opportunities must first be identified and then targeted. Long-term service trends should be analyzed in order to facilitate a better understanding of market needs. Most importantly, a proactive market plan for service will stress profit planning rather than sales revenue growth.
- The actual process for proactive marketing is listed in Exhibit VI-4. While each step is important, the planning function (steps one to four) are the most crucial to the overall success of the plan. It is in these first four steps that the vendor sets the foundation for the plan. This foundation includes an understanding of both the user's needs and the vendor's ability to meet those needs.
- A marketing plan such as the one in Exhibit VI-4 is necessary because it forces the vendor to view service in strategic rather than tactical terms. While individual service products are important, the proactive marketing plan will permit vendors to maximize service profitability and at the same time integrate service more fully into the long-term design for company growth.

DEVELOP A CUSTOMER SERVICE MARKETING PLAN



2. "STRATEGIC PARTNERING" IN THE SMALL-SYSTEM SERVICE ENVIRONMENT

- Once a vendor establishes a marketing plan and begins to understand the user's service requirements, the next logical step is to satisfy those requirements. Many small-system vendors however, do not have the resources to meet all user requirements for service. Some large-system vendors such as Honeywell and NAS have entered new (generally TPM) service markets in order to use excess service capacity, but this is rare among small system service vendors who are typically struggling to maintain simple geographic coverage, not to mention specialization by region.
- Just as in the rest of the industry, small-system service vendors have fallen prey to the concept of "NIH" (Not Invented Here). NIH has a slight variation in service environment because it refers to maintenance by a particular vendor's service staff. Vendors typically view the service market as what services they can offer, not what the market requires for service. This attitude invites user dissatisfaction and customer-base erosion.
- Small-system service vendors should use the technique of "strategic partnering" in order to develop or maintain service products that are required by the user base. Strategic partnering has long been used in the hardware environment in order to build up sagging product lines, or to keep abreast of the latest technology. Companies like Burroughs have used outside help (Convergent Technologies) to develop a small business computer line. DEC and Sperry bought into Trilogy for access to new technology. Even IBM has been active in developing strategic partnerships to meet specific goals (Motorola, Rolm, and Intel are just a few examples). Service organizations, however, have not been quick to follow this strategic partnering example.
- INPUT recommends that the service vendor allow user needs to motivate strategic partnerships. If geographic coverage is a weak link, work with another vendor to provide service in the regions not served by the manufac-

turer. If peripherals are the problem, subcontract the service out to the original manufacturer. Vendors must accept that, in some cases, they will actually be subsidizing their own competition. But in the long run this subsidization will be offset by improved user attitudes regarding overall service.

- On an informal basis, service vendors have used strategic partnering for a long time—for example, contracting with a TPM vendor to provide service to a remote location, or a DEC FE working on a CDC disk drive in order to keep a particular customer happy. INPUT is suggesting that vendors should consider strategic partnering on a global basis when they have identified service requirements that they cannot currently satisfy.

3. SERVICE QUALITY

- All the small-system vendors interviewed by INPUT indicated that they believed that service quality was essential to the ongoing success of their business. This response was essential to the ongoing success of their business. This attitude was not surprising; few, if any, companies would admit to placing quality in a low priority position. However, many small-system vendors measure "quality" by some internal means such as MTTR or number of system interruptions. The vendors typically neglect to consider the true measure of service quality--conformance to user requirements.
- Conformance to user requirements is at the top of the list in Exhibit VI-5 as a major component of service quality. This means that quality of service should be measured not by vendor standards, but by user standards.
- One of the most important advantages of a high level of conformance to user service requirements (i.e., high-quality service) is that it costs the service vendor so little. In fact, improved service quality can result in lower costs and improved revenues. Costs can be lowered, for example, when it becomes clear that most users place little or no value on a particular service. Vendors can then drop the service or price it according to the needs of the minority of users that actually require the service.

SERVICE QUALITY IS . . .

- **Conformance to User Requirements**
- **Measurable by Both User and Vendor**
- **At Worst: At Best: Cost Reduction**
- **Path to Long-Term, Profitable Operations**
- **Applicable to Every Aspect of Service**

- A much more significant result of improved service quality is the major contribution it makes to long-term profitable service operations. Users have been open about the fact that service is very important and that, in many cases, they prefer to pay a premium and receive improved service. Several vendors are just beginning to recognize the potential value of improving the quality of service, but INPUT expects much more activity in this area in the next three to five years.
- On a more negative note, large-system service vendors that do not satisfy the quality requirements of users generally have very low customer satisfaction rates. Not coincidentally, these vendors are also losing market share in both service revenue and hardware sales. Users surveyed by INPUT have consistently rated the quality of service as one of the most important considerations in purchasing a system. When these service requirements are not met, users become highly motivated to find replacement service vendors (TPM vendors) or to acquire a new system altogether--both of which result in reduced profitability for the vendor.
- Small-system vendors may be susceptible to problems in the area of service quality because of their past reliance on OEM vendors, value-added resellers, and a relatively sophisticated end-user population. Companies such as Wang and Data General grew so quickly that their service organizations could not keep up and customer dissatisfaction with service was quickly translated into a negative effect on sales.
- As small-system vendors continue to follow high-growth markets such as office automation and on-line transaction processing, it should be expected that service needs of the customer base will change. Small-system service vendors must be prepared to adapt to these changes particularly in the area of software support and professional services. Ultimately, customer satisfaction with service quality will determine the long-term success of each and every small-system service vendor.

APPENDIX A: SMALL-SYSTEM VENDOR QUESTIONNAIRE

APPENDIX A

SMALL-SYSTEM VENDOR QUESTIONNAIRE

1. Many of the small-system service vendors are increasing the number of services offered to customers as a way to increase revenues and to improve user satisfaction. What type of post-sales support services does your department now offer or plan to offer in the next 3 years?

	<u>Current</u>	<u>1987</u>	<u>Please Describe</u>
- Planning	___	___	_____
- Consulting	___	___	_____
- Documentation	___	___	_____
- Training	___	___	_____
- Site Audits	___	___	_____
- Software Support	___	___	_____
System	___	___	_____
Application	___	___	_____
- Remote Diagnostics	___	___	_____

2. a. Dispatching technology has advanced very rapidly in the last few years. Do you see these changes in dispatching helping your field services group?

- b. Do you offer or plan to offer centralized dispatching?

2. (Cont.)

c. Does your company have local, regional, or national dispatching?

d. Please rate your dispatching performance. _____

e. Has new technology increased performance? _____

f. Describe the organization structure of your dispatching unit _____

g. Is parts tracking a function of dispatching? _____

3. a. Spare parts inventory is usually the second largest budget item for customer service organizations (coming right after personnel expenditures). Controlling these parts inventories is a major goal of most service vendors. Is your capital investment in spares growing?

b. What factors influence your parts investment? _____

c. Do you have parts depots on a national or regional basis? _____

3. (Cont.)

d. How many parts depots does your company have? _____

e. Are parts depots at repair depots? _____

f. What impact have parts depots had on productivity improvements in your company?

4. a. Please describe the remote support services that your company offers.

b. Does the customer receive a discount or a premium for using remote support?

c. What systems or products are covered by RSS? _____

d. What was the impact of remote support services on customer support?

e. What trend do you see in remote support? _____

5. a. We have noticed that in the last 2 or 3 years many of the major service vendors have been building up their depot service networks. Do you think that depot service will significantly impact on-site service?

- b. Do you offer T&M or contract rates at depots? _____

- c. What products are covered by depot service? _____

- d. What channel of distribution do you use? _____

- e. How do you market depot service? _____

- f. How do you price depot service? _____

6. a. Users have indicated to us that the number of call-backs has been growing, particularly as the number of experienced FEs has decreased. Is your customer services group tracking the problem of call-backs and, if so, how do you plan to reduce call-backs?

- b. What percent of completed fault calls are completed in the first call?

6. (Cont.)

c. What percent of call-backs have you experienced? _____

d. Are you achieving goals for MTTRepair? (Y/N) _____

MTTResponse	
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12
13	13
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98	98
99	99
100	100

MTBF _____

System

Availability

7. a. Software support, in the minds of many users, has already become as important as hardware support. How do you see this trend toward increasing software support requirements affecting your customer services department and what is your department doing to meet these requirements?

b. Does your company offer:

YES / NO

DESCRIBE

- **System Software Support**

- **Application Software Support**

- Training on Software

- Support Centers

Regional

National

- Rothnis

- On-Site Support

- User Involvement

- Software Consulting

8. a. Single-source maintenance and third-party maintenance is becoming increasingly popular among the small service vendors. Honeywell, DEC, and NAS all have just recently announced major expansions in this area. How do you see this affecting your field service options?

- b. Will you offer these services? _____ Describe: _____

- c. On what products? _____

- d. Please describe TPM or Single Source as it relates to:

- Parts _____
- Pricing _____
- Training _____
- Documentation _____
- Software Support _____

9. a. Customer service is becoming more and more competitive with the growth of TPM, single-source vendors, and new service vendors such as AT&T. How is this going to affect your pricing policies for field service?

- b. When and why do you change service prices? _____

9. (Cont.)

c. Do you offer discounts for any of these features?

	<u>Yes/No</u>	<u>PLEASE DESCRIBE</u>
- User Involvement in Maintenance	_____	_____
- User Delivery of Plug-in Modules	_____	_____
- Relaxed Requirements on Response Time	_____	_____
- Remote Diagnostics	_____	_____
- Volume Discounts	_____	_____
- User Purchase of Parts Kits	_____	_____
- Invoice Prepayment	_____	_____

10. Where do you see field service prices going in the next 2-3 years?

11. Service guarantees such as guaranteed availability and guaranteed response time are an attractive option to many users. Where do you see guarantees fitting into the future role of your field service group?

12. a. Personnel costs are the most significant portion of field service expenditures. Improving staff productivity is one method vendors are using to improve their competitive position in service. How do you measure the field engineer's productivity and do you foresee any major changes in overall service staff productivity?

12. (Cont.)

b. Are FEs becoming more productive? _____

c. Do you measure:	<u>Yes/No</u>	<u>PLEASE DESCRIBE</u>
- Revenue per Engineer	_____	_____
- Personnel per Equipment	_____	_____
- Expense to Revenue	_____	_____
- Down Time	_____	_____
- Number Call-Backs	_____	_____

13. Please complete the following personnel matrix:

	SOURCE OF NEW EMPLOYEES	TURNOVER 1983 (Percent)	EXPECTED GROWTH	TOTAL NUMBER
Junior FE				
Senior FE				
Software Support				
Line Manager				
Staff				

14. a. Field service revenues are always a touchy subject, but would you say that FS revenue growth has matched your expectations this year?

- b. Was FS department profitable? _____ Please Describe: _____

- c. What level of growth? _____

- d. What are some of the factors affecting FS growth? _____

- e. What were FS revenues? _____

- f. What were FS expenses? _____

15. Do you think that the field engineer should be involved in any of these sales or sales-support functions:

	<u>Yes/No</u>	<u>DESCRIBE</u>
- Making Goodwill Calls	_____	_____
- Software	_____	_____
- Maintenance Contracts	_____	_____
- Attending Sales Meetings	_____	_____

APPENDIX B: SMALL-SYSTEM USER QUESTIONNAIRE

SMALL-SYSTEM USER QUESTIONNAIRE

1. On a scale of 1-10, how important are each of the following maintenance factors in computer purchase decision-making: (1 = least important, 10 = most important)
 - a. Price (of maintenance) _____
(Q1A)
 - b. Uptime or system availability _____
(Q1B)
 - c. Response time _____
(Q1C)
 - d. Repair time _____
(Q1D)
 - e. Vendor reputation _____
(Q1E)

2. On a scale of 1-10, please rate your maintenance vendor in the following categories:
 - a. Hardware service engineers' communication _____
(Q2A)
 - b. Software service engineers' communication _____
(Q2B)
 - c. Overall service image of the vendor _____
(Q2C)
 - d. Dispatching _____
(Q2D)
 - e. Escalation _____
(Q2E)
 - f. General responsiveness of the vendor _____
(Q2F)

3. a. What is your requirement for hardware response time? _____ (hours)
(Q3A)
- b. What do you receive? _____ (hours)
(Q3B)

4. a. What is your requirement for hardware repair time? _____ (hours)
(Q4A)
- b. What is the average repair time (once the FE is on site)? _____ (hours)
(Q4B)

5. a. What is your requirement for software response time? _____ (hours)
(Q5A)
- b. What do you currently receive? _____ (hours)
(Q5B)

6. a. What is your requirement for software fixes? _____ (hours)
(Q6A)
- b. What do you currently receive? _____ (hours)
(Q6B)

7. a. What overall level of system availability do you require? _____ %
(Q7A)
- b. What level of system availability are you experiencing? _____ %
(Q7B)

8. a. How many system interruptions do you have each month? _____ (Q8A)
- b. What percentage of system interruptions are hardware related? _____ % (Q8B)
- c. And software related? _____ % (Q8C)
9. Do you have a requirement for any of the following services, and if so, what would you consider a reasonable premium to pay over the basic maintenance charge?

Service	1 = Yes, 2 = No Yes / No	Reasonable Premium (percent)
a. Stand-by coverage during critical periods	_____ (Q9A1)	_____ (Q9A2) %
b. Guaranteed uptime	_____ (Q9B1)	_____ (Q9B2) %
c. Guaranteed response time	_____ (Q9C1)	_____ (Q9C2) %
d. On-site spare parts	_____ (Q9D1)	_____ (Q9D2) %
e. Remote diagnostics	_____ (Q9E1)	_____ (Q9E2) %
f. Preventive maintenance and field changes during off-prime hours	_____ (Q9F1)	_____ (Q9F2) %
g. Occasional shift coverage (versus fixed schedule)	_____ (Q9G1)	_____ (Q9G2) %
h. Full-time, on-site service engineer	_____ (Q9H1)	_____ (Q9H2) %
i. Guaranteed repair time (hardware)	_____ (Q9I1)	_____ (Q9I2) %
j. Guaranteed turnaround on software fixes	_____ (Q9J1)	_____ (Q9J2) %

10. a. Please rate, on a scale of 1-10, your requirements for the following vendor goods and services.
- b. Please rate your current level of satisfaction with the services you receive from your maintenance vendor.

Vendor Goods & Services	Requirement (a) 1-10	Current Level (b) 1-10
a. Planning (environmental, physical site installation)	_____ (Q10A1)	_____ (Q10A2)
b. Consulting	_____ (Q10B1)	_____ (Q10B2)
c. Documentation	_____ (Q10C1)	_____ (Q10C2)
d. Training	_____ (Q10D1)	_____ (Q10D2)
e. Sales of supplies	_____ (Q10E1)	_____ (Q10E2)
f. Add-on sales	_____ (Q10F1)	_____ (Q10F2)
g. Site audits	_____ (Q10G1)	_____ (Q10G2)
h. Relocation/deinstallation	_____ (Q10H1)	_____ (Q10H2)
i. Hardware maintenance	_____ (Q10I1)	_____ (Q10I2)
j. Software maintenance	_____ (Q10J1)	_____ (Q10J2)

11. Would you favor or oppose having the field service engineer take orders for:
(1 = favor, 2 = oppose, 3 = neutral)

- a. Supplies _____
(Q11A)
- b. Add-on equipment _____
(Q11B)
- c. New models _____
(Q11C)
- d. Upgrades _____
(Q11D)
- e. Service contracts _____
(Q11E)
- f. Software _____
(Q11F)

12. Please rate the importance of receiving your hardware and software support services by the following methods: (scale 1-10)

	(1-10)	
	Hardware	Software
a. Your involvement in telephone diagnosis, working with support center	_____ (Q12A1)	_____ (Q12A2)
b. Your involvement with remote diagnostics and software down-line loading	_____ (Q12B1)	_____ (Q12B2)
c. Your replacing circuit boards, or patching software	_____ (Q12C1)	_____ (Q12C2)
d. Ship in/carry in to repair center	_____ (Q12D1)	_____ (Q12D2)
e. Consulting/software customization	_____ (Q12E1)	_____ (Q12E2)
f. Traditional, on-site response to trouble calls	_____ (Q12F1)	_____ (Q12F2)

13. Do you currently use third-party maintenance on any of your equipment?

(Q13) (1 = yes, 2 = no) IF YES, GO TO QUESTION 15.

14. Have you considered using third-party maintenance? _____ (1 = yes, 2 = no) IF YES, GO TO QUESTION 20. IF NO GO TO QUESTION 21.
(Q14)

15. a. Which third-party vendor are you currently using? _____
(Q15A)

b. And for which product? _____
(Q15B)

16. Do you receive third-party maintenance in: (1 = yes, 2 = no)

a. Per call _____ or b. Contract _____
(Q16A) (Q16B)

17. If contract:

What is your response time requirement?(1 = yes, 2 = no)

a. 2 hrs. _____ b. 4 hrs. _____ c. 8 hrs. _____
(Q17A) (Q17B) (Q17C)

d. Other _____
(Q17D)

18. What type of coverage do you receive? (1 = yes, 2 = no)

a. Mon. - Fri. _____
(Q18A)

b. Saturday _____
(Q18B)

c. Sunday _____
(Q18C)

19. On a scale of 1-10, how satisfied are you with the third-party maintenance you are now receiving? _____
(Q19)

20. When considering third-party maintenance, how important are each of the following criteria to you? (1 = not important, 10 = very important)

a. Price of third party maintenance _____
(Q20A)

b. Improved response time _____
(Q20B)

c. Third-party vendor reputation _____
(Q20C)

d. Hardware support _____
(Q20D)

e. Software support provided by the third-party vendor _____
(Q20E)

f. Overall system uptime (guarantee) _____
(Q20F)

g. Geographic accessibility _____
(Q20G)

h Other features (spares, diagnostics) _____
(Q20H)

21. On a scale of 1-10, how important is a single source of maintenance to you?

(1 = not important, 10 = very important) _____
(Q21)

(A single source of maintenance provides a single maintenance contract for all DP products at your site.)

22. Please rate the importance of the following single source maintenance contract features: (1 = not important, 10 = very important)

a. Improved convenience _____
(Q22A)

b. Improved response time _____
(Q22B)

c. Knowledge of site _____
(Q22C)

d. Reputation of single-source vendor _____
(Q22D)

e. Avoids "finger pointing" _____
(Q22E)

23. Do you currently use a Local Area Network in a conjunction with your small computer and/or word processor? (1 = yes, 2 = no)

(Q23)

a. If yes, which vendor? _____
(Q23A)

1. Star _____
(Q23A1)

2. Ring _____
(Q23A2)

3. Bus _____
(Q23A3)

b. If no, do you plan to in the next two years? _____
(Q23B)

24. Who maintains the network? _____
(Q23)

25. What is your most significant LAN maintenance concern? _____

26. In your opinion, what single change should your maintenance vendor make to significantly improve the level of service?

THANK YOU.

**APPENDIX C: SOFTWARE SUPPORT CORPORATE
QUESTIONNAIRE**

**SOFTWARE SUPPORT
CORPORATE QUESTIONNAIRE**

Introduction :

INPUT is a research and consulting firm. We are conducting a study on issues and trends in packages software support and maintenance from the corporate customer's standpoint. We will make recommendations on how corporations can best deal with these issues in the coming years. We would like your organization to take part in this study by describing what you are doing now, what your plans are and what problems you see. This information will be used by IS departments in their planning and will also be used by a wide variety of information service vendors to offer more useful products and services.

None of the information that you provide will be associated with your company. In return for your taking part in this study, we will send you a summary of this study on its completion and will also send you a summary of INPUT's report PC Software Support in Large Corporations.

1. a) Are you responsible for all significant packaged software support matters in your organization?

☐ Yes ☐ No

If No to 1.a)

- b) Are you knowledgeable about all significant packaged software support matters in your organization?

☐ Yes ☐ No

If No to 1.b)

Which of the following are you Responsible for or Knowledgeable about:
(Note with "R" or "K")

	Operating System(s)	Other Systems Software	Application Software
Mainframe			
Minicomputer Software			
Microcomputer Software			

(NOTE: get names of other people to complete the matrix).

For the rest of this interview I would like to discuss with you your support requirements for _____ software. (If respondent is responsible for one area select that; if responsible/knowledgeable in more than one, follow instructions).

2. Who are the suppliers of your major software packages, categorized by software type (Operating systems, Other Systems Software, and Applications Software) and Hardware Type? (Use following matrix).

Software Suppliers

Software Type			
	Operating System(s)	Other Systems Software	Application Software
Hardware Type			
Mainframe			
Minicomputer - IBM Sys 38, - Series 1, - 8100			
DEC Minicomputer			
Prime Minicomputer			
Data General Minicomputer			
Other Mini _____			
Office/PC - IBM PC Family - Other			

3. a) Using these same categories, about how much did you spend in 1983 on:
- Software licenses, fees, lease or rental payments, etc? \$ _____
 - Software support or maintenance fees either in dollars or as a percent of License fees? \$ _____
_____ % of license fees.

b) For what percent of your software is support included in the license fee? _____ %

c) What percent of your software is not supported by the vendor? _____ %

d) Overall, how much do you expect these to change in 1984 and 1985? (\$ or percent change)

Changes in:

	Total License Fees	Total Support Fees
1984		
1985		

e) If any of the changes in 3d were significant (i.e., 10% or more):

- What is the reason for this? _____

Do you expect this amount of change to continue? _____

4. a) I will read a list of functions or services that are sometimes or usually included as part of standard software support services. Please tell me how important each is to your organization generally and whether there are exceptions, depending on the type of package? Please be specific about the exception (e.g., from a particular vendor, for a particular application, at a particular location, for a particular type of machine). Please rate them importance on a scale of 1 to 5 with 1 being low importance and 5 representing high importance.

SOFTWARE SUPPORT FUNCTIONS
IMPORTANCE

Functions	Generally	Exceptions
Fix Errors		
Improve Features of Functionality		
Add Features or Functionality		
Extend Features or Functionality		
Training		
Consulting		
Other (Describe) _____		

4. b) How well have your software vendors generally met these support requirements? Have certain vendors performed much better or worse? (Note: Specific vendor names are preferred, but generic descriptions are acceptable; Please rate your satisfaction by the same functional areas (on a scale of 1 to 5).

Satisfaction with Software Support

Functions	Generally	Exceptions
Fix Errors		
Improve Features or Functionality		
Add Features or Functionality		
Extend Features or Functionality		
Training		
Consulting		
Other (describe) _____		

5. a) What kinds of services do your software vendors offer in addition to those contained in the standard support contract (e.g., additional training, consulting)? How extensive are they?

5. b) About how much do you spend annually on these additional services?

\$ _____

- c) What additional services do you expect to purchase from your packaged software vendors?

● When: _____

● Why?: _____

● What would this translate to in dollars? \$ _____

6. a) Have you experienced situations recently where a software vendor has brought out a new product rather than enhancing or modifying an existing product?

☐ Yes ☐ No

● If Yes:

- Which product(s) was it? _____

- Do you feel this was justified? ☐ Yes ☐ No

Explain: _____

- Did licensees of the old product receive a discount on the new product? ☐ Yes ☐ No

If Yes, how much was it and was it fair in your opinion?

- Overall, do you feel the vendor(s) handled the situation well from your standpoint? ☐ Yes ☐ No

Why? _____

6. b) Do you think that bringing out new products in this way will be a more common situation in the future?

☐ Yes ☐ No

Why? _____

If yes, will this be common for:

- ☐ Mainframe Software
☐ Mini Software
☐ Micro Software

7. a) Does your organization keep logs or other records of major and minor bugs or other problems in packaged software?

☐ Yes ☐ No

● If Yes:

- How many major and minor problems are reported annually for operating systems software, other systems software and application software packages? How many are resolved? What is the average time to resolve these problems? (Use attached matrix.)

7. a) Problem Reporting or Resolution

	Package Type		
Problems	Operating System(s)	Other Systems Software	Application Software
<u>Major</u>			
Number Reported			
Number Resolved			
Average Time to Resolve			
<u>Minor</u>			
Number Reported			
Number Resolved			
Average Time to Resolve			

7. b) Overall, is this problem resolution performance satisfactory?

☐ Yes ☐ No

If No:

How should it be improved? _____

To what extent do you expect it to be improved? _____

7. c) How much do you expect automatic downloading and installation of new releases, remote diagnostics, and remote fixes to improve problem resolution and other services? Are these being done now at your installation? If so, what is your experience?

	Being Done Now (Yes/No)	Expected Improvements	Experience
Automatic Down-loading and Installation of New Releases			
Remote Diagnostics			

8. a) Is there one person in your company who tracks and analyzes software support contractual terms and conditions for all software products?

☐ Yes ☐ No

● If Yes:

- How long has this been done? _____
- How many products are covered? _____
- What benefits has your company received? _____

● If No:

- Do you plan to? ☐ Yes ☐ No

8. b) Do you feel that current contractual terms and conditions applying to software support and maintenance are satisfactory?

☐ Yes ☐ No

Why: _____

• What sort of changes would you like? _____

• What kind of changes do you believe vendors are planning? _____

- c) Does your firm ever seek to modify standard terms and conditions concerning software support?

☐ Yes ☐ No

Why? _____

If Yes:

- How often is this attempted? _____

- What terms do you try to modify? _____

- What success have you had? _____

9. To what extent do you feel you have little or no choice in the type or amount of software support you will be receiving?

- What can you do about this? _____

- What are you going to do about it? _____

10. a) How much and what kind of self-support of packaged software is your organization currently doing?

Why? _____

10. b) Do you usually, sometimes or never perform the following types of self-support? What are your future plans? (fill in matrix below)

Type of Self-Support	Current			Future		
	Usu.	Some	Never	Usu.	Some	Never
Install Initial Release						
Install Subsequent Releases						
Modify Packages						
Fix Errors						
Set up a Single Point in your Organization to Funnel Questions to a Vendor						

- c) Do you expect to do more in the future? ☐ Yes ☐ No

Why? _____

If yes:

What kind of self-support? _____

- d) What kind of incentives do software vendors now give you to perform self-support functions?

10. e) What additional incentives would you find attractive? _____

11. What other software support issues are important to you or your organization?

12. Overall, what changes do you see occurring in the way in which packaged software support is delivered?

